MISSOULA
COUNTY

MISSOULA CITY-COUNTY HEALTH DEPARTMENT
WATER QUALITY DISTRICT
301 WEST ALDER
MISSOULA, MONTANA 59802-4123

(406) 25890 FAX # (406) 258781
website: www.co.missoula.mt.us/waterquality

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Doug Martin
Natural Resource Damage Program
P.O. Box 201425
Helena MT 59620-1425

Dear Doug,

Missoula County has completed its review of the Draft Restoration Plan for the Clark Fork River and Blackfoot River near Milltown Dam. Written comments are enclosed with this letter, prepared by Mr. Dennis Gathard of G & G Associates and Peter Nielsen of Missoula County. Thank you for providing us with a copy of the draft report and the opportunity to submit comments.

We appreciate the initiative taken by the State of Montana and the other natural resource trustee agencies in developing the Draft Restoration Plan. The Natural Resource Damage Program and the other natural resource agencies involved with the project are to be commended for committing the time and resources to this project. We recognize that this is a complicated and challenging project, made all the more difficult by the need for coordination with the Superfund remediation project at the site. The County looks forward to working closely with the State in evaluating and finalizing the restoration design. These comments offer specific constructive criticism of the draft plan. Our fundamental goal is to help make the project successful. In that regard, I hope that these comments are constructive.

Public Participation

The DRP states that the plan will be submitted for peer review and public comment. The plan has been submitted for peer review, but the results of this peer review have not been made public. The plan has not yet been distributed for public comment. Missoula County recommends that the plan be submitted for public review and comment following revisions made to the plan as a result of peer review or other comments received to date. The plan should provide a complete portrayal of proposed restoration work, including work proposed on the Blackfoot River not currently included in the plan. The plan should address alternatives to the proposed restoration approaches. The plan should include well developed objectives and criteria, including additional objectives and criteria for public safety and structural stability. The plan should address impacts of removal of the Stimson Dam upstream of that dam, risk analysis of proposed design features, and an assessment of construction timing and potential affects on neighboring residents and landowners, irrigators, fisheries, groundwater users and other potentially affected parties. And the plan should address coordination with site redevelopment

planning, coordinated by the County and the Milltown Superfund Site Redevelopment Working Group.

We believe that public interest remains very strong in the draft restoration plan. The work proposed will have significant potential impacts on the local community and on environmental resources valued by County residents. Competed restoration work at the site will also dictate feasibility of potential site redevelopment alternatives. The draft restoration plan has been prepared through a process that so far has been largely closed to public participation and review. We believe the project can not successfully move forward without public involvement, and we recommend that the State not underestimate the need for public involvement before proceeding to final design.

Plan Objectives, Criteria and Alternatives Analysis

More clear objectives and criteria should be developed for this project. The plan lacks clear, consistent goals and objectives from section to section. Inclusion of clearly defined objectives allows development of project alternative approaches. Insufficient information has been provided describing how the projects' goals can be met using the proposed techniques.

Furthermore, the Draft Restoration Plan (DRP) evaluates only one potential approach for modifying and restoring the Blackfoot and Clark Fork Rivers following remediation. Without detailed objectives and discussion of alternative means of meeting those objectives, the stability, safety, future conditions and associated construction and maintenance costs cannot be readily evaluated. The plan sets out one preferred approach to restoration design, with incomplete justification and without the supporting information required for evaluation. Missoula County believes that several alternatives should be evaluated prior to proceeding to final design.

The plan lacks clear definition of criteria for critical aspects of the plan, including structural design, weir location, hydraulic characteristic design, and safety criteria against which the design of the proposed approaches can be measured. Traditional engineering criteria should be used for analysis and design to ensure stability of the restoration.

The plan does not address alternative approaches to restoration, with the exception of several alternative channel locations above the Duck Bridge. Several restoration approaches are possible, ranging from more traditional engineering approaches for grade and alignment control to allowing the river to naturally recreate a new alignment and channel. Alternative weir designs and locations were not provided. Alternative use of natural bedrock and well developed pre-dam alluvium downstream of the confluence as grade control should be carefully considered. Alternative weir designs should be evaluated based on stability, hydraulic, aesthetics, public safety and fish passage criteria. Alternatives for locating the river vertically and horizontally should be explored and advantages and disadvantages of each developed. This analysis should include potential removal of contaminated sediments proposed to be left in place.

Missoula County previously submitted comments on the Draft Conceptual Restoration Plan. We supported the DCRP's proposed restoration objectives. We were especially supportive of the proposed objectives to establish naturally functioning and self-maintaining rivers, use natural materials, improve aesthetic values and provide recreational opportunities. Following review of the 2005 DRP, we find that these objectives should be re-evaluated.

The first objective listed is:

• Restore the CFR and BFR in the Milltown Reservoir Sediment Operable Unit (MRSOU) to be naturally functioning and self-maintaining.

A naturally functioning river would meander through CFR 2. Because contaminated sediments would be left in place in CFR 2, this objective can not be reasonably attained. Use of rock weirs and vegetation to provide a long-term stable profile and plan form may not meet the objective of a self-maintaining river, or the objectives of stabilizing contaminated sediments in place, maintaining infrastructure stability, or providing for recreational use.

Page 3-8, Section 3.2.2.1, Channel Grade Control and Bank Stabilization Methods, states that "Maintaining both vertical and lateral channel stability will be necessary to maintain channel-floodplain connectivity and to limit the scour of contaminated sediments to be left-in-place on the CFR floodplain." This is repeated in Appendix H, page H-1, where the DRP states that maintaining vertical and lateral stability is necessary to reduce risks of mobilizing contaminated sediments and that the State has determined that allowing "excessive" migration of the river would be unacceptable. This is inconsistent with the restoration objective referenced above. Missoula County also questions the ability of the proposed w-weir, rock sill and cross-vane structure designs to provide vertical and lateral channel stability permanently. See comments attached prepared by G & G Associates

Missoula County also has significant concerns over potential public safety hazards associated with restoration designs. Please add an additional objective related to public safety, as follows:

Design in-stream and bank protection structures so that they do not create reasonably avoidable hazards to the public.

Structural Stability

The proposed location of critical grade control weirs at the downstream end of the project would subject the upstream elements of the project to the risks associated with failure of those weirs. Placing weirs at other locations may have significant advantages in terms of reliability, maintenance and cost. Other issues include the cost and stability associated with reforming CFR 3 through mature cottonwood stands and design of the Blackfoot River profile.

The structural stability of the overall design is not evaluated. Proposed grade control structures were not designed using designated criteria for structural and hydraulic design. Proposed weirs do not appear to have been designed to withstand large flow events or extreme ice events. The proposed structures may not be appropriate for the purpose of long-term grade control.

Traditional engineering criteria should be used for analysis and design to ensure stability of the restoration.

Public Safety

Public safety is an important consideration in design of restored stream channels and instream restoration structures. The State of Montana stream classification for the Blackfoot and Clark Fork Rivers includes bathing, swimming and recreation, and growth and propagation of salmonid fish and associated aquatic life. The Blackfoot and Clark Fork Rivers already receive substantial public recreation use. When the two dams are removed, the public will be able to

access two new stretches of river for floating. Since these river reaches are in close proximity to the Missoula urban area, and the rivers are easily accessible, high levels of public use should be anticipated and planned for. The Department of Fish, Wildlife and Parks has conducted river recreation use surveys on the Blackfoot River. FWP reports detail the type and distribution of recreation use in the Blackfoot River Recreation Corridor. We recommend that the trustee agencies review this information and plan accordingly for significant public use of the rivers through the restoration project area.

Potential hazards associated with proposed designs include recirculating hydraulics, limb entrapment, pinning on rocks or woody structures, and lack of adequate access and exit routes. Public safety objectives and criteria are not included in the Draft Restoration Plan. Objectives and criteria established in other states and projects should be evaluated and incorporated into the Milltown restoration project design. Mitigation measures are available for potential hazards, and should be evaluated as part of the restoration design. Qualified consultants should be retained by the State to evaluate restoration designs to ensure that public safety is a primary consideration in design. See attached comments specifically addressing public safety and recreation use.

Grade Control

What alternatives were examined to the w-weirs proposed for grade control at the bridges? (Page 2-28, Section 2.8.2 Infrastructure protection.) The document does not mention other alternatives considered. Some alternatives that may warrant further consideration include bridge pier protection, river bank protection, and alternative forms of grade control that meet the objectives of infrastructure protection, aesthetics, fish passage and public safety. Alternative forms of grade control may include u-shaped, compression structures designed for public safety. Missoula County has concerns over public safety of river recreation users at the proposed w-weirs.

In the second paragraph of Section 3.2.2.2, the plan explains the design of proposed grade control as follows, "A steeper vane arm gradient results in greater hydraulic acceleration over the structure and into the pool created by the structure. This acceleration is necessary for maintaining sediment transport through the pool and subsequently, the depth of the pool." We believe it is incorrect to justify this design based on "sediment transport." In fact these structures are designed with steep vane arms to provide sediment scouring, and desired pool conditions for large fish. The structures do not enhance sediment transport – they enhance sediment scouring below the structures to provide habitat for fish. We believe that the objective of providing scour holes below structures can be achieved without compromising public safety in the design of rock structures, and request that the State investigate alternative approaches where grade control is deemed necessary.

Criteria for grade control structures are listed as addressing bed stability concerns, increasing fish habitat distribution, and providing recreational boating opportunities where appropriate (Page 3-9, Section 3.2.2.2 Channel Grade Control Structures). These objectives should be reviewed carefully and revised. Additional criteria should include structural and hydraulic design, public safety, aesthetics, design life span, minimum structure spacing, and maximum gradient. Hydraulic design criteria should include maximum flood flow and event frequency, hydraulic characteristics for the range of flows, influence of hydraulic jumps on public safety, scour analysis and effects on structure depth, and lateral stability requirements. See attached comments from G & G Associates for more detailed comments on structural stability and hydraulic design. See attached comments regarding public safety of proposed restoration structures for suggestions on criteria that may address public safety.

Some grade control structures appear to be proposed with the objective of providing permanent protection to bridge piers and river banks near the bridges on the Blackfoot River. Other structures may be intended to provide temporary bed stability to provide protection for streambank vegetation until it is established sufficiently to stabilize the banks and floodplain of the restored river in CFR 2, CFR 3 and BFR 1. It would be helpful for the plan to specify whether proposed structures are intended to be permanent, or temporary. Longer design life spans generally resist larger loads and are constructed from stronger materials.

Increasing fish habitat distribution is a worthy objective, but is not a primary objective for channel grade control structures. Channel grade control structures can be designed to provide fish passage, and can potentially provide additional benefits in terms of habitat diversity by creating deep scour holes below each structure. But if that is the purpose of the structure, it should be called a fish habitat structure, not a grade control structure. Creating habitat is ancillary to the purpose of the grade control structure, which is to provide lateral and vertical channel bed stability and infrastructure protection.

On page 4-6, the DRP states that the proposed grade control structures will enhance recreational boating. Please see attached comments on public safety of the proposed structures.

Page 4-7, fourth paragraph. This section describes the proposed rock sill near the Duck Bridge site. The sill is generally described as a three foot trench filled with large rock. It would be built at a 90 degree angle to the river flow, all the way across the floodplain. The purpose of the rock sill does not appear to be fully described. The DRP states that the sill is needed to ensure that newly constructed floodplain remains secure until vegetation matures. What other purpose does the rock sill serve? Is it a grade control structure that is intended to reduce costs of channel excavation upstream? If so, how does this compare to the DRP objectives? Specifically, how does this fit with the objective to restore the CFR to be naturally functioning and self-maintaining?

What is the anticipated scour depth at this proposed rock sill at a variety of river flows? Is a three foot deep trench of sufficient depth to prevent potential scour undermining of the structure? Is a loose rock design stable in this setting? Is it intended to be permanent?

Assuming that grade control is needed at the Duck Bridge site, what alternatives for grade control were examined as part of the state's planning process? If alternatives such as U-shaped weirs have not been considered, we request that this be done.

A river-wide rock sill constructed at 90 degrees to the river flow across the entire floodplain raises substantial concerns for public safety. Will this structure create a submerged hydraulic jump? If so, has the State performed modeling to assess potential for creation of a recirculating hydraulic drowning machine below this proposed structure?

If the purpose of the proposed rock sill is to provide control to limit potential upstream headcutting, then it is prudent to assume that the headcutting will eventually occur in the reach between the confluence and the Duck Bridge area. If this headcutting occurs, it will erode the river bed downstream of the sill. The river will downcut until it reaches the footer. The sill will become exposed at the surface. Once exposed, it will potentially create a submerged hydraulic jump and a reversal hydraulic below the structure. Erosion of the downstream face of the rock sill could occur even if the downstream weirs function perfectly. The gradient in this reach is steeper than most other reaches in the project area. If the river profile flattens to a more typical

gradient, a drop could materialize at the Duck Bridge sill without headcutting action from downstream.

Since the sill would be built at 90 degrees to river flow and extend across the floodplain, it could create a significant drowning hazard with little or no opportunity for escape, such as that which occurs below low head dams. This concern is heightened by the reliance on downstream loose rock structures to provide a stable downstream bed elevation. If these downstream structures are temporary, or unable to maintain vertical bed elevation permanently, then the river will someday seek a lower elevation in the lower end of the project area and headcutting will eventually occur up to the proposed rock sill. If the downstream structures are designed to be permanent, but fail, the same scenario will occur. If the rock sill becomes exposed, it presents a serious public safety hazard. If it is not stable, then it too will fail and upstream restoration work will become vulnerable to erosion and unraveling.

Section 4.4.1, page 4-5 CFR Proposed Treatments. This section describes the proposed rock cross vane just above the current dam site. However, the DRP does not describe the purpose of the proposed cross vane. Why is it necessary to construct a rock cross vane at this location when bedrock is apparently within a few feet of the proposed invert elevation? This section also describes the proposed w-weir below the current dam site. The DRP states that this structure will provide grade control. What is the design life span for these structures - are either or both of these structures intended to be permanent? Why is elevated grade control necessary at the island downstream of the dam? What alternative designs were examined for grade control? If alternatives have not been examined, we request that this be done.

Attached is a copy of a sketch from the K. Ross Toole Archives at the University of Montana Mansfield Library, showing test piles and channel configuration at the site of Milltown Dam prior to its construction. The drawing shows a river channel that cuts deep as it passes by the rock cliff on the left river bank. The drawing also shows the river bed at or near bedrock depth. In order to restore this river to near natural conditions, the restoration design should seek to construct the new river channel through the dam site at an elevation that approximates historical conditions. The pre-dam natural channel appears to have been limited vertically and horizontally by bedrock. Artificial bed elevation controls do not fit with restoration objectives that seek "natural" restoration. If the river is artificially elevated, and the rock structures ultimately fail to control the bed vertically, then the river will eventually seek a lower elevation. This would threaten the investments made in restoration upstream.

Section 4.5.1, page 4-14. Revegetation Treatments. This section begins with a statement that the elevation of the island below the dam would change, and the channel narrowed. This is repeated in appendix G, page G-23. What is the purpose of raising the elevation of the island? Will the thalweg also be raised at this location? How much will it be raised, and what is the purpose of this action? Why remove native vegetation and the stability that vegetation provides at this location? What grade control is already created by the island and railroad bridge constriction at this location without raising the elevation of the island? Why not rely on natural bedrock grade control just above the current dam site, which is only a few feet below the proposed elevation of the cross-vane grade control at that point?

Coordination with Redevelopment Planning

The DRP addresses coordination with remediation within the remediation project area. The plan should also address coordination with redevelopment planning. For example, the DCRP proposed construction of a pedestrian bridge at the Duck Bridge site. The DRP does not include

the bridge. Trails and footbridges have been proposed by the Redevelopment Working Group and County for site redevelopment following remediation and restoration. If the Duck Bridge footbridge is still proposed by the state, it should be included in the draft restoration plan released for public review. The plan should also address how site grading and modification may affect proposed locations of trails and footbridges.

The DRP states (Section 4.4.2, page 4-6) that wetlands were designed to optimize wetland credits for the area. It would be helpful for the public if the DRP would describe this in more detail. Loss of wetlands and perceived loss of wetlands in the Milltown Reservoir area has been a point of contention in the past. Many local residents remain concerned about losing wetland resources which are viewed as important resources in the community. Additional explanation of the design principles and wetland credits would help the public understand this issue and how the DRP would address wetland restoration.

One recommendation of the Milltown Superfund Site Redevelopment Working Group was to develop a winter ice skating area at one of the restored wetland sites near the Two Rivers Community Park. This plan has been discussed within the group for more than a year, and was presented to the public as part of the group's recommendations earlier this year. We were surprised to learn, through reading the DRP, that maximum water depth in the restored wetlands would be one to three feet. The depth of water in floodplain wetlands will be largely dependant on river flows and groundwater depths. In this environment, groundwater would reach its maximum elevation in May or June, and minimum depths would occur in December or January. It is not unusual in alluvial floodplain aquifers along the Clark Fork River to have an eight to ten foot variation between peak seasonal groundwater elevation and minimum seasonal elevation. Assuming the groundwater elevation varies by eight to ten feet in this area, if the proposed wetlands would be only one to three feet deep during peak groundwater season, they will be dry in the winter time and unusable for recreation. Groundwater would be five to nine feet below ground surface. At a recent meeting of the redevelopment group, State project staff mentioned that fire trucks might be used to fill the ponds. This clearly will not work in an alluvial system with unlined wetlands.

It is unfortunate that the State did not inform the Redevelopment Working Group of this potential limitation during the group's planning process. Staff from the Natural Resource Damage Program, Fish Wildlife and Parks, and other trustee agencies attended most if not all of the group's meetings, but this limitation was not brought up. As a result, the group has finalized its conceptual plans, which are apparently in conflict with the draft restoration plan. The redevelopment group has offered the plan for public comment, and hosted public open houses at which the skating pond concept was described. Department of Fish, Wildlife and Parks staff helped staff the recreation station at the open houses at which the skating pond recommendation was presented. The public now has a clear expectation that a skating pond is feasible, and that we will try to build it. This situation may lead to further discord within the local community on the lost wetlands issue. If one of the ponds can not be maintained at a sufficient depth to allow winter recreation, an explanation should be offered to the public and the Working Group.

The Redevelopment Working Group also proposed two river access sites be developed as part of site redevelopment. How will site grading and restoration design affect the proposed access site locations? The group also requested that stream channel design and rock structures placed in the river be natural looking, provide safe passage by all forms of non-motorized watercraft, and enhance desirability for recreational use. The DRP has proposed several forms of rock structures that are not natural in appearance, and may present public safety hazards. The structures were

not evaluated to enhance desirability for recreational use. The Working Group and County have requested that the State consult with a river recreation engineer to enhance the value of grade control/bank stabilization for river recreation, and to recognize that bank design should anticipate concentrated public use near access points and rapids.

The Working Group and County have also proposed an Interpretive Center be constructed near the current dam site. How will site grading and restoration design affect this potential location? Are there other limitations that will constrain the use of this site?

Weed Management

The plan recommends weed management continue annually for three to five years following project completion (Section 3.3.5, page 3-13, Weed Management.). The plan should recognize that weed management will be an ongoing responsibility of the manager of lands at Milltown. A period of three to five years will only get the project through the first cycle of weed seed germination for those areas treated with a persistent herbicide, such as Tordon. If weed management is not carried through past this time frame, it will almost certainly be unsuccessful. The Missoula County Extension Service and Weed District may provide some guidance and assistance with this project. We will provide additional comments on the revegetation and weed management aspects of the plan at a later date.

Blackfoot River and Stimson Dam

Section 4.3.3, Page 4-4, BFR upstream starting point. This section contemplates design and implementation of restoration activities upstream of the BFR bridges following the removal of both dams and sediment scour in the river. We are familiar with the uncertainties mentioned in the DRP regarding the final scour depths along the Blackfoot River. However, we disagree that the design and implementation of restoration for this reach be delayed until after the drawdown and dam removals. We believe that the draft restoration plan should provide the public with a complete picture of how the restoration will look and function in the project area. Leaving out a portion of the planning area from the plan raises considerable uncertainty for the public. For example, the folks in Milltown who live and own property along the BFR will understandably be vitally interested in the restoration designs for this reach. Designs chosen have the potential to affect these neighbors in a significant way. And, if we wait until after the dams are removed and reservoir sediments are scoured to begin designing a remedy, this would result in a delay of at least one year prior to completion of restoration work along that stretch of river. This will leave river banks in a raw condition unless interim revegetation measures are taken.

A more appropriate approach would be to finalize design for the entire project, determine downstream and upstream bed elevations, and have the whole plan available for public review and comment prior to construction.

Page 1-3, Section 1.2 states the extent of the work on the BFR will be limited to just upstream of the Stimson Dam. Should Stimson dam removal show that scour estimates provided by Envirocon are incorrect further work on the BFR may be required. Please refer to the County's comments on the Stimson Dam removal from fall, 2004.

Data confirming the upstream limits of erosion should be gathered. The scour evaluation indicates that termination of scour associated with Stimson Dam removal is just upstream of the current dam reservoir. Confirmation of a natural grade control that limits this upstream scour should be made before removal of the dam to ensure that no additional mitigation is required.

The Phase 3 design process may be affected by upstream limits of erosion from Stimson Dam removal.

Other Comments

Section 4.4, page 4-4 Reach specific channel and floodplain recommendations. The DRP states that only structures deemed critical for coordinating with the remedial action are addressed in detail, and that additional structures will be finalized in phase 3. This is confusing. The DRP does not include details on many proposed structures within the remedial project area, including those in CFR2 and BFR1.

Thank you again for the opportunity to review and comment on the Draft Restoration Plan. We would welcome the opportunity to meet with you and your consultants to review these comments.

Sincerely,

Peter Nielsen

Peter Nielsen
Environmental Health Supervisor

Cc: Board of County Commissioners
Dennis Gathard

Review Comments

Draft Restoration Plan for Restring the Clark Fork River and Blackfoot River following the Remova1 of Milltown Dam

Summary

The DRP provides geomorphic analysis and some details regarding the planned development of proposed new river characteristics including profile, plan form, cross section, and stabilizing structures. Objectives of the design developed in the DRP appear to be intended to provide a stable, natural appearing river alignment, in areas that are now reservoir, using natural materials to accomplish this goal. This is a laudable goal and should be encouraged to the extent that such an objective meets with other goals and objectives. However, it is our conclusion that insufficient information has been provided describing how all the proposed goals can be met using the proposed techniques. Furthermore, no alternative methods of meeting the objectives were presented for comparison to more traditional approaches.

Use of more traditional "engineered" means of river control can indeed destroy the aesthetic objectives of river restoration but may need to be considered in some form to meet all the project goals. Some of the proposed river stabilization methods described in the DRP may not meet design criteria typically developed for such projects. For structural or hydraulic reasons, these criteria may preclude or require substantial modification of some of the grade control approaches suggested.

Overall, we found the DRP not to have clear, consistent goals and objectives from section to section. Objectives are stated very broadly at the beginning of the document. Objectives are inferred or stated without description of how those goals meet the overall project objectives, in following sections. Inclusion of clearly defined objectives allows development of project alternative approaches. For the most part no alternatives to the proposed plan are presented. With out detailed objectives and discussion of alternative ways to meet those objectives the safety, stability, future conditions, and associated construction and maintenance costs cannot be readily evaluated.

We could find no clear definition regarding the criteria for locating weirs, structural design, hydraulic characteristic design, or safety criteria against which the design of the proposed features such as grade control weirs would be measured. Typically the project goals would state the objective of restoration and construction activities in selected reaches, provide several alternatives to meet those goals, and show basic analysis by which those alternatives were evaluated.

In reviewing the DRP we developed the following list of general issues that we believe would need to be resolved before beginning final design of the restoration project. These issues are explained briefly below and addressed further in following comments.

General Areas of Concern

1. **Presentation of clear project objectives**. While the document provides a great deal of information, discussion of the project objectives, which are required to

comment on and review the document, were either overly broad, not actual objectives, or not complete. The first step in a restoration project should be determination of the objective of the project so that alternatives can be developed that lead to solutions.

2. **Presentation of well defined alternatives**. Using clearly stated goals and objectives allows the development of project alternatives. While alternatives may have been discussed internally, no alternative approaches were discussed in this document.

3. **Clearly developed design criteria**. Typically, before design of a project can move forward to design level documents, a document must be developed that provides clear guidance regarding the design of elements that meet project goals and objectives.

4. **Lack of sufficiently broad criteria for design of river restoration elements**. The criteria for restoration of river features should include traditional engineering criteria for analysis and design to ensure stability of the restoration. Safety criteria should also be developed for recreation uses of the river.

5. **Structural stability of overall design in extreme events**. No designated criteria for structural and hydraulic design of the rock weirs were proposed as a means to provide grade control. As proposed, they do not appear to have been designed to withstand large flow events or extreme ice floe events. The event that would destroy grade control features not designed for extreme events could occur soon after completion of the construction of grade controls and change the profile grade of the river in the design reaches. Grade stability will also affect the cost of mitigation for the foundation of the County pedestrian bridge across the BFR. If grade control structures fail head cutting could allow deeper scour than scour protection designs anticipate, possibly causing bridge failure.

6. **Appropriateness of proposed type of structures for long-term grade control**. No precedent for use of rock weirs as a means of stabilizing contaminated sediment was found. Considering the river size, recreational use, and the project objective of permanent sediment containment upstream of the reservoir, solely relying on rock weirs as the means to restore the river may not be appropriate. The type and construction of proposed grade control weirs are generally used on smaller rivers to enhance fisheries habitat. A review of experience at other sites using these types of weirs shows that structural failures have occurred and that their design may present boater safety hazards.

7. **Design of profile and horizontal alignment through critical BFR and CFR reaches**. Except in CFR3, no alternative concepts for profile and plan were presented. Alternatives for locating the river vertically and horizontally should be explored and advantages and disadvantages of each developed. The location of

grade control weirs at the most downstream end of the project subjects all the upstream elements of the project to the risks associated with failure of these weirs. Placing weirs at other locations may have reliability, maintenance, and cost benefits. Other issues include the cost and stability associated with reforming CFR3 through mature wooded areas and design of BFR profile.

8. **Investigation of impacts of removal of Stimson Dam upstream of the dam**. Assumptions regarding the terminus of the erosion from removal of the Stimson Dam must be verified before design concepts can be complete. The gradient from the end of the reservoir area to the upstream terminus of the erosion after removal shown in the scour analysis is significantly steeper than other sections of the river. If the gradient is flatter and more similar to other sections of the river further upstream erosion may occur. This could affect assumptions regarding mitigation requirements upstream of Stimson Dam and grade control requirements on the BFR.
9. **Risk analysis of the proposed design features**. No discussion was provided regarding the relative importance of the various elements of the design and the interactive relationship of the elements. Failure of a weir at the upper reach may not have the same significance as failure of the downstream weirs. Design criteria safety factors should reflect this difference. Location of features required to maintain the stability of the river alignment and design of scour features for upstream bridges may also result from this analysis. The analysis should also evaluate the consequences of loss of grade control and lateral confinement features should the design level event be exceeded.
10. **Recreation safety**. Only passing reference was given to the subject of recreation on the river and how the design affects safety. Proposed grade control may present safety issues for boaters.
11. **Affects of proposed restoration design for redevelopment plan.** No discussion of how proposed elements of the DRP will affect the *Conceptual Redevelopment Plan for the Confluence of the Clark Fork and Blackfoot Rivers and Adjacent Communities.* The Redevelopment Plan includes bridges, river access, interpretive facilities and trails potentially affected by the design.
12. **Construction Timing**. No discussion regarding the construction schedule's effects on neighboring residents such as homes on east bank of Blackfoot River in Milltown and river water users such as irrigators, fisheries, and groundwater users.

Detailed Comments

Project Goals/ Objectives

- Better description of the relationship between Phase 2 and Phase 3 design would provide a better understanding of which objectives need to be clarified for this document and which can be refined in a later phase of the work.
- It is not clear that the objective of restoring the MRSOU to be “naturally functioning and self maintaining” (Section 3) can be accomplished through use of grade control structures.
- The singular project objective stated in Section 1.2 is “to restore ecological and hydrological functions” to the rivers. This objective is sufficiently broad to allow many interpretations. However, no discussion of alternative horizontal and vertical alignments was found. Other objectives are stated throughout the document. A comprehensive discussion of goals and objectives that allows each section of the document to fit within these overall and detailed objectives should be developed. The guiding principals of the restoration are only implied.
- Section 3 objectives. Use of rock weirs and vegetation to provide a long term stable profile and plan form may not meet the objective of a self-maintaining river, stabilizing in place contaminated sediments, maintaining infrastructure stability, or recreational use. How will meeting these objectives in the short and long term the long term be evaluated? What criteria will apply to this objective?
- Revegetation objectives appear to be a description of the general results of revegetation rather than a specific set of goals for revegetation of this project.
- Section 2.8.2 states that use of riprap violates the restoration objectives without further explanation. Alternative measures using hardened surfaces such as riprap for alignment control and minimizing future maintenance should be explored in greater depth than presented in this section.
- The wetlands and landowner objectives are referenced without stating the objectives.
- Cut and fill balance is mentioned in Section 4.4.2 as an objective in passing without development of the implications to the project. Balancing cut and fill is generally not an objective but a means to satisfy either cost or topographic objectives. However, these objectives are not discussed.
- Some of the references to objectives would appear to be addressed as design criteria. For instance, Section 4.4.3 refers to grade control objectives, which could be met by design features. Generally, grade control is a response to an objective, such as stabilization of the plan form or vertical alignment, not an objective. Section 4.4.5 describes transition objectives, which may also be

simply a design feature that meets some other project objective. Section 4.4.6 indicates that maintaining sediment transport is an objective that would appear to be design criteria chosen to meet project stability goals.

Alternatives Analysis

- Several general river restoration approaches are possible, ranging from allowing the river to naturally recreate a new alignment to construction of concrete and steel structures that completely confine and control alignment.
- Allowing the river to recreate a new alignment would violate the objective of controlling the erosion of upstream sediments and possibly cause erosion of moderately contaminated left bank CFR2 sediments. However, if insufficiently stable grade and alignment control measures are used for the chosen alternative, results may be the same as choosing the alternative that allows the river to naturally choose a new alignment. Unless rigorous generally accepted analysis techniques are applied to the design of grade and alignment control structures, there is no means to show that the proposed approach of using rock weirs and plant material to provide stabilization will result in an outcome different from allowing the river to initially choose its own course.
- No discussion was presented discussing the advantages and disadvantages of using more traditional approaches that would provide long term grade and alignment controls. Typically more extensive weirs and hardened embankments are required to fully meet the objective of material confinement upstream of the dam.
- No discussion of alternatives to locating weirs was provided. Two weirs at the downstream end of the reach and one at the Duck Bridge provide the critical grade control for the rest of the project. Locating these weirs to provide the best long term stability will be critical to the success of the project. A limited list of alternatives, not discussed in the DRP, includes the following.
    a. ***No grade control***. It is not clear that rock weirs will provide any long term grade control benefits as presented. If downstream grade control fails upstream weirs could become safety and passage barriers. Allowing the river to define the profile and confining contaminated sediments with longitudinal hardened surfaces may provide a more stable and more natural functioning river.
    b. ***No weir construction downstream of the confluence of the BFR and CFR***. This approach would decouple the effects of floods on the rivers. Natural rock surfaces located approximately 360 feet upstream and well developed predam river alluvium located approximately 400 downstream of the dam would provide natural vertical alignment control. Grade control structures could be located upstream of the confluence. Gradients

on both rivers may be slightly greater than currently proposed but would be with the range of gradients shown on the proposed *Design Plan and Profile* document. Failure of grade control on the BFR would be decoupled from failure on the CFR and vice versa.

c. ***Buried Impermeable High Strength Grade Control***. Construct more traditional engineered structures using concrete and steel below river thalweg. Construct natural appearing river surface structures. The natural river structures could extend up and down stream to avoid scour and exposure below grade of concrete structures. The concrete structure could extend to a depth that would ensure the long term stability of critical downstream grade control structures.

d. ***Construct Longer Grade Control Structures to Increase Stability and Prevent Safety Hazards***. Rock weirs may not meet structural design requirements and may present safety hazards to boaters and swimmers. Increasing the longitudinal dimension of the weirs could solve these problems.

Design Criteria

Design criteria for structural stability, aesthetics, hydraulic efficiency, and safety should be developed. Structural criteria are available such as Corps of Engineers Manuals that include strength design for hydraulic structures such as Corps Manual EM 1110-2-2104, Strength Design for Reinforced - Concrete Hydraulic Structures. Weir design should include consideration of the size of flood event used for the design. Design criteria will need to address hydraulic performance and hydraulics related to boater safety and river passage.

Structural Stability and Hydraulic Design Criteria should include the following:

- The design requirements to aid in location of grade control structures along the river. These may include requirements such as maximum gradient and minimum distance between structures.
- Design life span i.e. temporary or permanent grade control structures. It is not clear from the document whether the grade control structures are intended to permanently or temporarily stabilize the river. Design life span usually addresses this concept. Longer design life spans generally resist larger loads and are constructed from stronger materials. It is not clear how the objective of contaminated sediment confinement can be met if the structures are considered temporary.

- Hydraulic design loading and operating criteria for structure design. This would include:
  - The maximum flood flow and event frequency which grade control structures are required to survive will need to be determined.
  - Hydraulic characteristics for the range of flows and the influence of hydraulic jumps on safety criteria
  - Scour analysis and effects on structure depth requirements including margins of scour analysis error and factors of safety
- Lateral Stability Requirements i.e. Buried grade control devices to restrict avulsions
- Ice Loads.

Other design criteria that may need to be considered and included but are not clearly defined by the document include:

- Aesthetic Requirements. It may be possible to meet both aesthetic and structural requirements if the structural elements of weirs are located below grade.
- Fisheries Requirements
- Safety Requirements.. Hydraulic design criteria should address scour, boat trapping submerged supercritical flow, and fisheries criteria for low flow conditions.

Horizontal Alignment /Plan Form

- An objective stated in Section 3 is to provide a design that protects against erosion of CFR2 and CFR3 sediments not removed during remediation. Section 3.2.2 indicates that proposed treatments would be designed to “minimize” lateral channel migration and then goes on to state that vegetation will provide long term stable banks. However, if bank erosion is just minimized the objective of sediment containment could be violated. Vegetation is not generally recognized as a contaminated sediment stabilization technique. To accomplish this goal structural features may be constructed to restrict erosion of this material in the designated flood event. Protection could take the form of a buried hardened surface that restricted river migration. Design of this hardened surface would require stipulation of loading criteria, dimensional criteria, and margins of safety. No mention of these types of structures was found.
- Even mature stable rivers eventually change horizontal alignment, usually as the result of extreme events. No analysis was presented regarding the risk associated an evulsion that causes the river to change course causing erosion of confined sediments. Since confining contaminated sediments is one of the stated objectives

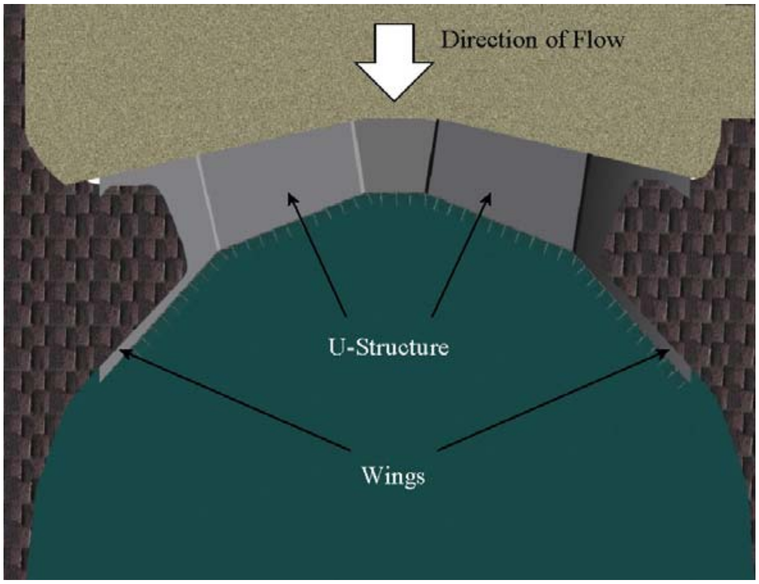
of the project evaluating the proposed treatments against other approaches that would accomplish this objective would appear to be essential. Without some means to ensure lateral stability of the river other than rock weirs and vegetation, some of which will be removed as part of the project, it is not clear that the proposed river treatments actually meet the objective even in the short term. This is especially true if the structures and vegetation only provide protection for typical flows. In this case the structures are only effective at protecting against lower flows that don't pose a threat to lateral and vertical stability.

- The proposed profile at the downstream end of CFR3 is similar to the current thalweg elevation (approximately 3246 now versus approximately 3250 proposed). Treatment of CFR3 includes increasing sinuosity and removing mature vegetation. This would appear to create less stability rather more stability since, as discussed, mature vegetation provides a more stable river plan form than recent vegetation.

Weirs

- No discussion of design parameters for weir stability and function was presented. Section 4.4.2 refers to these structures without describing how they function or the time frame for which they are intended to function. If these features are to be considered stable features of the restoration work they will need to be designed to resist design loads from a predetermined flood flow, ice floes, and seismic loads. The details of weir structure design criteria should include scour depth, flood flow, design life span, ice loads, seismic loads, and hydraulic performance criteria for public safety and to ensure proper materials are used in the construction.
- Weir design criteria may need to include means to eliminate scour beneath the weir in high flows. This may mean extending scour protection much deeper than proposed by the design described in the Draft. Appendix H describes scour depths much greater than the proposed depth of the weirs. No scour depth was shown for CFR2, which is possibly the most critical reach for the stability of the restoration. The depth of the structural elements in this reach should ensure that they do not erode during the design level flows.
- Safety concerns about the design of these weirs must be included in the design criteria. Abrupt or steep dropping weir downstream surfaces will cause high velocities which could present boater safety issues. Protruding shallow sharp rock faces could present severe safety hazards if high velocity water directs boaters into these rocks.
- Longer flatter sloping riverbed surface should be considered in weir designs to reduce water velocity.
- Structural designs should consider use of compression only structures to eliminate the need for tensile structural elements that have limited life span and the need for

extensive engineering and construction requirements. The figure below illustrates a weir design with the structural stability of a compression structure.



This figure was taken from *A Comparative Study of a W-weir and U-drop in the San Juan River in Pagosa Springs, Colorado.*

- As proposed in the DRP, the Duck Bridge weir depth would not appear to be able to avoid failure from scour because the scour depth is greater than the footer depth. Once the weir is undermined, upstream profile degradation and sediment erosion is likely, violating the objective of containing contaminated sediments.
- Loss of downstream weir elevation control would likely initiate head cutting upstream along the CFR to the Duck Bridge weir and along the BFR to rock outcroppings that potentially control the BFR grade upstream of Stimson Dam. Head cutting could cause the drop at the Duck Bridge weir to be greater than anticipated. A moderate head drop at this weir would cause boating safety hazards, reduce the stability of the weir by increasing scour at the toe of the weir, and ultimately could lead to the failure of the weir. Head cutting on the BFR could cause bridge foundation failures and impacts on other infrastructure.

Profile Grade

- No discussion of alternative means to provide a stable profile through the downstream reach was discussed in the plan. The proposed approach constructs downstream rock weirs to provide a stable vertical alignment for the entire upstream reach.

- No illustration of pre-dam thalweg through the entire reach was found. Illustrating the predam profile as a means of assessing the appropriate post dam profile gradient on has been used at many of other similar dam removal projects, including Elwha, Condit, Matilija, and San Clemente dam removal projects.
- An alternative not explored in the DRP includes addition of more weirs with smaller drop features, such as rock lined bed structures. This could reduce the impact of failure or deterioration of a single weir by reducing the amount of drop at each structure. The proposed 2 foot drop at the two most downstream weirs would increase if the downstream weir deteriorates. This could present fisheries and recreational passage issues at various flow levels.
- Treatment of the scour hole downstream of the Milltown Dam may influence the functioning of the downstream weirs.
- Between station 56+00 and 60+00 the gradient is shown in the *Design Plan and Profile* as approximately 1.5%. Section 4 of the DRP describes this reach as having an average gradient of 0.36%. This may be related to the confluence of the two rivers. However, it would not appear to be a stable feature considering discussions presented in Appendices C and H. Several weirs may be required in this reach to ensure a stable configuration at the confluence. Alternatively, the grades of the rivers could be made to be approximately equal before the confluence.
- Evulsions may be likely to occur at the confluence of the river due to complex mixing and scour at high flows. Hydraulics of this area should be thoroughly understood before design of control structures. Buried hard surface erosion control structures should be considered in the design because of the importance to stability of the upstream elements of the project.
- All assumptions about reaches upstream of CF2 depend on the stability of this reach. However, Appendix H does not consistently include analysis of CFR2. No explanation of this inconsistency could be found. For instance, the only design analysis in this section for CFR2 was the Leopold and Wolman analysis for channel form. That analysis concluded that a braided channel was appropriate based on slope as shown in Figure H-1. However, H.2.4.2 describes the proposed design of the reach as meandering.
- The long term stability of reach CFR1 will be essential for design assumptions about the stability of BFR and CFR reaches upstream to be valid. Construction of the most downstream weir, which includes building the island higher than current elevations, would seem to add additional uncertainty to the stability of the design. The DRP shows the most downstream weir elevation at 3228. The survey information developed for the DRP shows the thalweg of the stream at the weir location to be at elevation 3224. This could present a significant passage

barrier at lower flows by creating a large drop at this weir. A four foot high structure would require structural design to ensure long term stability. Filling, stabilizing, constructing several more grade control structures upstream of this grade control feature would appear not to add stability to the river design.

- The island downstream of the dam may be already artificially elevated due to scour for so many years of large material at the foot of the dam. The larger scoured material may have been transported only as far as the island, raising its overall elevation. Evidence of this may be seen in the steeper gradient immediately downstream of the island. The survey shows a drop of 8 feet in the thalweg for the 1,230 feet just downstream of the upstream end of the island, for a profile gradient of approximately 0.7%. This grade is much steeper than other nearby reaches.
- Greater stability may result from using the naturally existing grade control elements such as rock outcroppings just upstream of Milltown Dam and the island downstream of the dam for grade control and adding structures upstream of the confluence of the rivers.
- The scour pool immediately downstream of the dam should be filled with stable subgrade material before the end of the construction. Using large rocks such as 10 inch diameter material from the dam foundation could also pose a risk by causing high subgrade porosity. If the river thalweg is not fully formed with naturally occurring riverbed material, an unstable bed may develop in the reach between weirs. This condition could cause stability and hydraulic problems to develop. Allowing the pool to fill naturally could allow for a 2 foot drop at the next upstream weir at low flow conditions if the current design is implemented. Unless the weir is designed to meet public safety guidelines for recreational use, that magnitude of drop may present a passage barrier for recreational boating.
- Envirocon’s analysis of predam alluvial surfaces in Section 4.4.6.1 was used as a means to show that the proposed profile was below predam alluvium. This appears to be inconsistent with the need to place downstream weirs. Why are weirs required if the proposed profile is already below predam alluvium? It is not apparent how both the downstream (weirs to either elevate or maintain river elevation) and upstream end of the reach could be at or higher than predam elevations and the profile be below predam alluvium.

Stimson Dam Removal

- Page 1-3, Section 1.2 states the extent of the work on the BFR will be limited to just upstream of the Stimson Dam. However, should Stimson dam removal show that scour estimates provided by the contractor are incorrect further work on the BFR may be required.

- Data confirming the upstream limits of erosion should be gathered. The scour evaluation indicates that termination of scour associated with Stimson Dam removal is just upstream of the current dam reservoir. Confirmation of a natural grade control that limits this upstream scour should be made before removal of the dam to ensure that no additional mitigation is required. The Phase 3 design process may be affected by upstream limits of erosion from Stimson Dam removal.

THE STATE OF MONTANA'S RESPONSES TO MISSOULA COUNTY COMMENTS ON THE *DRAFT RESTORATION PLAN FOR THE CLARK FORK RIVER AND BLACKFOOT RIVER NEAR MILLTOWN DAM* (April 2005)

Introduction

On April 26, 2005, the State of Montana provided a copy of its *Draft Restoration Plan for the Clark Fork River and Blackfoot River Near Milltown Dam (DRP*) to the Missoula County (County), among others. This plan was prepared in consultation with two other natural resource "Trustees," namely, the U.S. Fish and Wildlife Services (USFWS) and the Confederated Salish and Kootenai Tribes (CSKT). The State requested the DRP be reviewed and written comments be submitted by a panel of experts in the fields of geomorphology, engineering, fisheries, and geochemistry. Representatives of Missoula County and ARCO were also welcome to comment; only Missoula County submitted written comments.

The comments received have been numbered so that the various comments relating to the same topic to which the State is responding can be readily identified. Similar comments are listed and addressed together; other comments are listed and addressed individually. The State's responses to the comments indicate what changes, if any, that the State will make to the DRP and when the change might be incorporated into the restoration planning process. Once the DRP has been revised, it will be submitted for formal public comment.

This response could be prefaced with a statement that clarifies the intent of the Phase 2 DRP as a data collection and concept validation phase. Many Missoula County comments recommend the exploration and analysis of additional concepts and alternatives. Although the County's comments are constructive and useful toward Phase 3, alternative concept exploration occurred previously in the EPA RI/FS and in Phase 1, during which the original Draft Conceptual Restoration Plan for the Clark Fork and Blackfoot Rivers Near Milltown (DCRP) underwent public comment.

Comment 1: DRP Organization. The peer reviewers and the County commented that the DRP's length and organization made it difficult to follow the methodology used to arrive at the alternative design.

Response: The State recognizes this comment. The State does not propose to spend the time or resources to rewrite the DRP to address this comment. This comment will be taken into consideration in future documents that are developed.

Comment 2: Goals and Objectives. The peer reviewers and the County believes that the goals and objectives presented in the DRP need to be updated to include

enough data that the goals can be measured to determine if the project is success. The County recommended adding goals for public safety and structural stability.

Response: The State agrees with the comment that the goals and objectives need to be revised. The State also agrees that public safety should be added as a goal. The State believes a goal specifically addressing structural stability is implicent in the DRP since floodplain and channel stability are already goals and requirements. A new set of goals and objectives is attached.

Comment 3: Additional Sediment Removal. Peer reviewers and the County recommended additional sediment removal, specifically the sediment to be left in SAAIII-b.

Response: The State has considered the removal of sediments that are to be left in place, specifically the sediments within the CFR channel just upstream of the dam. The ROD requires these sediments be protected from scour and be located out of the 100-year floodplain. The removal of these sediments is estimated at $5 to 8 million dollars. Given the requirement that these sediments will be protected from scouring by the remedial action and given the limited funds that have been allocated to this restoration project, the removal of these sediments does not appear to be a cost effective alternative.

Comment 4: Redevelopment Group Coordination. The County commented that the DRP discusses coordination with remediation activities but does not discuss coordination with the Redevelopment Working Group (RWG) that has been formed in the Milltown/Bonner area. The County also stated that the State did not inform the Redevelopment Working Group of the potential limitations of the group's ideas, specifically wetlands, during the meetings held to develop it's redevelopment plan.

Response: The State and other Trustees participated to some degree in the Redevelopment Working Group meetings as technical advisors. The RWG went through brainstorming sessions and during these sessions the group's moderator, as well as State technical advisors from NRDP and FWP, recommended not limiting the brainstorming process by things that may or may not occur, either as part of remediation or restoration actions, since it was uncertain exactly what would be the final result and whether the RWG could secure funding of its proposals. The County's comment that the State should have previously indicated that wetlands would not be deep enough for a skating pond is not well taken since the brainstorming sessions were not setup to limit ideas. Moreover, the restoration grading plan was an integral part of the court-ordered confidential negotiation. Furthermore, under the terms of the CD, the wetlands grading can still be revised.

The DRP was developed to integrate and coordinate with the remedial action and meet the requirements of the CD and the EPA ROD. The RWG's conceptual

plans were not included because it is believed that these can best be integrated at a later date once more information concerning the remedial and restoration activities and schedules are known and once the RWG's plans are finalized and funding is definitely secured. This is the same type of process that is taking place along Silver Bow Creek. Certain restoration projects such as additional vegetation plantings are worked into the remedial process. Other projects, e.g., recreational trails, proposed by the Greenway Service District are later integrated once the remedial and restoration designs are known or developed.

It is the State's understanding that many of the redevelopment projects need to be implemented after remedial and restoration actions are completed and their uncertainities worked out. For instance, the work that the RWG wants to complete within the remedial project area will need to wait until the remedial and restoration actions are complete in the area and final land ownership is known. There will be several years to prepare and plan the integration these projects while waiting for the completion of other actions. In the meantime, the State will gladly consider redevelopment proposals and work to accommodate appropriate proposals to the extent practical.

Comment 5: Restoration Approach / Alternatives. The County recognized that several design approaches for channel alignment and slope were used; however, the County asserts that alternative approaches to weir design and grade control were not discussed. The County recommended bedrock and well developed pre-dam alluvium downstream of the confluence, as grade control should be considered.

Response: Refer to Response to Peer Review comments numbers 19, 20 and 23. The Phase 2 analysis was expected to evaluate and validate the design concepts proposed in the Phase 1 DCRP. Specific structure designs will be determined in the Phase 3 design work. A range of grade control structures were proposed in the DCRP, the DRP and additional recommendations were solicited from the Peer Group. To date, no additional specific design alternatives have been proposed. All proposed structure designs would be evaluated on a site-specific basis in the Phase 3 work. In general, our approach will be to use structures that most mimic surrounding streambed, streambank, and floodplain characteristics. However, we may deviate from this if required to stabilize banks so vegetation can become established and provide the long-term stabilization or to insure grade control.

Comment 6: Public Safety. The County has significant concerns over potential public safety hazards associated with the restoration design. The County requests that public safety be added to the list of goals and objectives for the project; specifically "Design in-stream and bank protection structures so that they do not create reasonably avoidable hazards to the public." The County also commented that the State should obtain the services of qualified consultants to evaluate the restoration design to ensure public safety. Also, the County believes the DRP proposes several forms of rock structures that are not natural in appearance, and

may present public safety hazards. G & G Associates comments that safety criteria should be used in design of structures and that structures near the dam as well as weirs may present safety hazards.

Response: As noted in the response to goals and objectives comment, the State agrees a goal concerning public safety should to be added. The State has obtained the services of qualified stream restoration consultants for this project. EPA also has a restoration design consultation role and has experts in this field who will comment. The State does not agree that additional consultants are needed to provide additional oversight. It has been the State's intention to consult with the County during the restoration design stages. If the County has additional technical comments concerning safety, they can be addressed.

It is one of the State's goals to reconstruct the Clark Fork and Blackfoot rivers so that in time the rivers will be self-maintaining and functioning, i.e., having well-vegetated banks and a floodplain that will allow some erosion. In order to reach this objective, floodplain vegetation must be well established and the proper channel and floodplain grades must be constructed; in-stream and bank structures are necessary to protect the floodplain and grade until the vegetation has the time to mature and become structurally effective. The structures proposed in the DRP are man-made and attempt to replicate structures found on other Montana rivers. For example, the DRP proposes to use root-wads in reach CFR 3 to stabilize banks and direct the flow away from the banks. Root-wads from cottonwood trees that have fallen into the river are common along the CFR. These trees are part of the river system; they fall into the river and become lodged against the banks of the river, protect the bank from additional erosion, and collect sediment and form areas where new vegetation becomes established. Rock vanes are also similar to features found on the rivers; however, the DRP proposes use of larger rock if necessary to meet the design criteria for flow events that these structures must withstand to protect the floodplain and grade in the short-term.

Comment 7: Review User Information. The County recommends that the Trustees review FWP user information concerning the Blackfoot River Recreation Corridor. Once the Stimson Dam and Milltown Dam are removed the public will have access to two new sections of river to float.

Response: The State recognizes this comment and comments that FWP is an integral part of the DRP development.

Comment 8: Grade Control At the Dam Site. The County has commented that the grade control at the current dam site needs to be further justified.

Response: The designers recognize the concerns and lack of detailed information surrounding proposed grade control structures. It is understood that more detailed analyses and documentation is required to demonstrate the function of these structures. The designers agree that grade control structures must undergo a

rigorous analysis that incorporates structural and hydraulic engineering design and will further consider the County's and recommendations of others during Phase 3.

The State's designers presently believe that w-weirs offer an appropriate solution for grade control at bridges with mid-channel piers. Not only do w-weirs provide grade control against head cutting and bed degradation, they also provide pier protection, bank protection, and fish passage. The designers disagree with the County's interpretation of the purpose and effects of w-weirs. Downstream scour holes are designed and constructed in conjunction with structure installation. Rather than create a new scour hole, w-weirs maintain a designed and constructed scour hole. More analysis will occur in Phase 3 to document the performance and appropriateness of w-weirs.

The designers are unfamiliar with u-shaped compression structures designed for public safety, but are willing to evaluate and consider them. The designers have experience with a similarly shaped structure called a cross vane, which is depicted on Sheet L-2 in the DRP.

The designers agree that clarification of whether grade control structures will be temporary or permanent would be helpful and will consider this issue in Phase 3. Bedrock may be substituted for grade control if the elevation of the bedrock corresponds to the design thalweg elevation. This determination will be made in Phase 3.

While bed stability is the primary objective for the proposed grade control structures, the structures also accomplish several other objectives including bank protection, flow energy dissipation, habitat enhancement and use of native materials. The designers recognize the importance of grade control and infrastructure protection, and believe that these and other objectives can be met without compromising stability.

Also refer to Responses to Peer Review Comments 19-22.

Comment 9: Rock Sill at Duck Bridge. The County asks: "What purpose does the rock sill serve? Is it a grade control structure that is intended to reduce costs of channel excavation upstream, if so how does that compare to DRP objectives? Specifically, how does this fit with the objective to restore the CFR to be naturally functioning and self-maintaining? What alternatives to grade control to the rock sill were considered?"

Response: The proposed rock sill at the Duck Bridge was proposed as a floodplain grade control to limit potential scour of the floodplain during over-bank flows until the floodplain vegetation can become established. The designers believe that floodplain grade control is required to resist floodplain erosion caused by flow acceleration generated by the proposed floodplain slope break and

gradual floodplain constriction beginning at Duck Bridge. The details of the proposed sill will be determined in the Phase 3 design, but the concept would be to bury rip-rap rock in one or more 3'x 3' trenches excavated down from the final floodplain surface elevation and extending south until the floodplain tied into the low terrace on the south bank. The proposed sill(s) would prevent surface erosion and head cutting that could lead to additional scour. The sill(s) are not intended to prevent a natural pace of channel migration, but simply to limit short term floodplain scour, which over time could lead to a sudden shift in channel alignment. Other options, such as combination log and rock sills, buried coir logs, brush windrows and other treatments will also be considered in the Phase 3 design. A practice that may be utilized throughout the restoration project area would be to locate similar sills wherever a grade control structure is located for a similar purpose (floodplain grade control until vegetation matures). The designers on a number of similar projects have used these practices successfully. The designers disagree that a rock sill buried in the floodplain could be a safety hazard.

Also refer to Responses to Peer Review Comments 21 and 22.

Comment 10: Wetland Design. The County comments that loss of wetlands and perceived loss of wetlands in the Milltown Reservoir area has been a point of contention in the past. Many local residents remain concerned about losing wetland resources that are viewed as important resources in the community.

Response: Wetland loss at the site is a result of the removal of Milltown Dam, thus the replacement of loss wetland acreages is ultimately not the responsibility of the State. The Consent Decree addresses the wetland issue. The State, in its design of the floodplain within the remediation project area, will optimize wetland acreage. With the dam in place there are approximately 164 acres of wetlands between the dam and Duck Bridge. The State's design presently calls for the replacement of as much of the wetlands loss between the dam and Duck Bridge as is optimal. The latest draft design has approximately 20 acres of depressional wetlands, 20 acres of wetlands associated with the river channels, and potentially 70 acres of floodplain wetlands. The estimated wetland acres created within the remedial project area are dependent on the depth to groundwater after dam removal and floodplain reconstruction. The depth of groundwater and the vegetation diversity established in the area will ultimately determine the total wetland credits.

Wetland mitigation upstream of Duck Bridge to mitigate the loss of wetlands due to dam removal is not required in the CD. The State's restoration design upstream of Duck Bridge, within reach CFR3, will also optimize the development of wetlands in this area. Again the total acres of wetlands created will be ultimately be determined in large part by the depth to groundwater.

<u>Comment 11: River Access.</u> The County commented that the RWG proposed two river access sites be developed as part of the site redevelopment. How will site grading and restoration design affect the proposed access site locations?

<u>Response:</u> The site regrading can incorporate river access sites. It is our understanding that the access site locations are conceptual. As stated above, the State believes there is ample time and sufficient locations to incorporate access sites into the project.

<u>Comment 12: Interpretive Center.</u> The Redevelopment Working Group and the County have proposed an Interpretive Center be constructed near the current dam site. How will site grading and restoration design affect this potential location? Are there other limitations that will constrain the use of the site?

<u>Response:</u> The State has seen the conceptual designs and location of the interpretive center. There does not appear to be integration issues with the restoration design. As for other limitations, there is a cultural resource site near this location. The County should discuss cultural resource issues with the Tribes. Also, future ownership of the property has not been determined.

<u>Comment 13: Weed Management.</u> The County comments that if weed management is not carried out through a period of longer that three to five years the weed management program proposed in the DRP will almost certainly be unsuccessful.

<u>Response:</u> The State agrees that weed management is an important issue at the site. Weed management was proposed for three to five years because future property ownership has not been determined. It is the NRDP's policy to conduct weed management for a three to five year period and then the responsibility reverts to the property owner. If the property were transferred to the State, weed management would be continued by the State. The State welcomes any advice the County may have garnered from controlling weeds in Missoula County.

<u>Comment 14: Blackfoot River Design.</u> The County comments that it is familiar with the uncertainties regarding the final scour depths along the Blackfoot River. However, it disagrees that the design and implementation of restoration for this reach should be delayed until after the drawdown and dam removals. The County feels the DRP should provide the public with a complete picture of how the restoration will look and function in the area. Leaving out a portion of the restoration planning area from the DRP raises considerable uncertainty for the public. The comment continues that if the State waits until the dams are removed and reservoir sediments are scoured to begin designing a restoration for this area, this would result in delay of at least one year.

<u>Response:</u> It is not necessarily the responsibility of the State to address the uncertainty concerning what the Blackfoot River and its floodplain will be like

once the sediments have scoured following the removal of the Stimson and Milltown Dams. The dams are being removed by actions implemented by the Settling Defendants and the United States. The contractor, Envirocon, has attempted, using modeling, to predict the riverbeds post dam removal scour surface, but there is uncertainty in this modeling and additional modeling will not eliminate this uncertainty. The uncertainty of the final scoured surface following dam removal is the reason the State has not completed additional design on the Blackfoot River. A conceptual restoration design is available to the public in the DCRP. Also, the work on the Interstate 90, Highway 200, and the pedestrian bridges will affect the final scoured surface and the types of restoration actions that may be implemented on the Blackfoot River. These uncertainties result in the restoration design being only conceptual at this time.

Comment 15: Stimson Dam Removal. The County comments that the extent of restoration work on the BFR will be limited to just upstream of Stimson Dam. Also, the County states: "The scour evaluation indicates that termination of scour associated with Stimson Dam removal is just upstream of the current dam reservoir. Confirmation of a natural grade control that limits this upstream scour should be made before removal of the Stimson Dam to ensure that no additional mitigation is required."

Response: The DRP states that the restoration actions associated with this plan "will extend on the BFR upstream from the confluence with the CFR, upstream to just below the Stimson Dam;" not "just upstream" as indicated in the County's comments. Also, evaluation of the scour associated with dam removal is the responsibility of those responsible for the removal of this dam and, consequently, these comments should be provided to EPA and the USFWS. Once the dam removals are complete, the appropriate restoration design for this area can be considered by the State.

Comment 16: Location of Structures. The County comments that the DRP provides no clear definition regarding the criteria for locating weirs, structural design, hydraulic characteristic design, or safety criteria against which the design of the proposed features, such as grade control weirs, can be measured.

Response: We agree that project goals and objective should be clarified to include how monitoring will be included to determine if the work has been successful. A principle purpose of Phase 2 was a data collection and concept validation. Many Missoula County comments recommend the exploration and analysis of additional concepts and alternatives. Although the County's comments are constructive and useful toward Phase 3, concept and alternative exploration has occurred in the Milltown site RI/FS process and in the Phase 1 DCRP, which underwent substantial public comment and agency responses. Comments related to design criteria are noted and will be addressed in Phase 3.

Also, refer to Responses to Peer Review Comments numbers 19 and 20 and the revised goals and objectives for the DRP.

Comment 17: River Restoration Design Criteria. The County comments that DRP lacks sufficient criteria for design of river restoration elements. The criteria for such elements should include traditional engineering criteria for analysis and design to ensure stability of the restoration.

Response: In the absence of a standardized approach to river restoration design, the approach employed in the DRP combines elements of several techniques that, in the designers' opinion, represent the best available methods for developing river restoration plans. Interpreting results, measuring channel stability and establishing design thresholds must rely on the practitioner's experience and judgment rather than an accepted or standardized set of traditional criteria.

The designers disagree that ample design criteria is not identified in the DRP. The DRP provides significant detail and design criteria for hydrology, river morphology, vegetation conditions, wetlands, aquatic and terrestrial habitat, and channel geometry including typical values for pattern, profile and cross section dimensions.

Comment 18: Stability of Design in Extreme Events. The County comments that the DRP contains no designated criteria for structural and hydraulic design of the rock weirs which are proposed as a means to provide grade control. It asserts that the weirs do not appear to have been designed to withstand large flow events or extreme ice floe events.

Response: Since questions exist regarding the performance of grade control structures over a range of discharges, Phase 3 will include a hydraulic analysis of proposed grade control structures such as cross vanes and w-weirs. All proposed structures are intended to function during extreme events. Please refer to the responses to comments 8 and 9 for additional information related to this topic.

Comment 19: Long-term Effectiveness of Structures. The County asserts that there is no precedent for use of rock weirs as a means of stabilizing contaminated sediment.

Response: It is not the State's responsibility under the Consent Decree to stabilize the contaminated sediments which will remain at the site, most of which are not highly contaminated. Engineered structures will be designed by Envirocon and approved by EPA and DEQ to stabilize and protect the more highly contaminated sediments at the site from future scour. The rock weirs proposed in the DRP are designed to stabilize the channel and bank for a period of time (10 to 20 years) until the floodplain vegetation becomes structurally effective enough to stabilize the floodplain.

Comment 20: Raising the Elevation of the island downstream from Milltown Dam. The County comments that no reasoning is provided for raising the elevation of the island downstream of the Milltown Dam.

Response: The DRP is incorrect on Pages 4-14 and Appendix G, G-23. The island will not be raised in elevation and the existing vegetation will remain intact. The two channels will be reshaped to the appropriate dimensions. These sections will be corrected.

Refer to the Response to Peer Review Comments 18 and 19 for a discussion of the design thought process relative to downstream grade control.

Comment 21. Design alternatives for BFR 1 and CFR 1 and 2. The County comments that no alternative concepts for profile and plan were presented for BFR 1, CFR 1 and CFR 2.

Response: Several options were initially developed for these reaches, however; given the necessity of integration with remediation (primarily the bypass channel and sediments left in place in SAA IIIb.), the project area was limited to a narrower belt width than may have been in place historically. While the belt width and floodplain width are narrower, the design concept of slowly narrowing the floodplain, belt width and meander pattern from a broad, unconfined valley (CFR 3) to a narrow, confined valley (CFR 1) was used to arrive at the final proposed channel design in CFR 2. The transition from a C4 to a B3 channel type is consistent with the geomorphilical setting and other reference reaches in the valley (see Sections 2.4 and 4.4 in the DRP).

Because the Consent Decree was still being negotiated during the development of the DRP, the parties needed more information in the remediation Project Area than in adjacent restoration project areas. To respond to these needs, a more detailed grading plan was developed for this area and was used to calculate cut and fill quantities. Thus, the restoration proposed action within the remediation Project Area is more detailed and received a higher level of scrutiny then adjacent river reaches.

Without further justification, no further alternatives will be developed in Phase 3 analysis. Also, refer to the introduction here and the response to comments 16.

Comment 22. Risk Analyses of Design Features. The County comments that the relative importance of various elements of the design and the interaction between the elements is not discussed.

Response: Comment noted. This topic will be addressed in Phase 3.

Comment 23. Construction Sequencing. The County comments that a construction schedule is not included for the restoration work.

Response: Once the remedial schedule is known, a restoration construction schedule will be developed and potential timing of impacts to landowners will be addressed. The State hopes to initiate work in the upper section of CFR 3 where weed control, revegetation and some channel stabilization may be occurring as early as 2006 or 2007. This section of the river is not affected by the remedial actions.

ATTACHMENT: REVISED GOALS AND OBJECTIVES

Draft Restoration Plan September 2005

Goals and Objectives[1]

The Trustees revised the goals and objectives presented in the Draft Conceptual Restoration Plan (DCRP) for the DRP per the peer reviewers recommendations. The review panel agreed wit the conceptual goals and objectives but suggested more explicit wording that corresponded with our more detailed data and understanding of the site.

<u>Overall Project Goal</u>: Restore the confluence of the Blackfoot and Clark Fork Rivers to a naturally functioning, stable system. This goal can be achieved with the understanding that:

- Infrastructure, contaminated sediment repositories, private land and the geomorphic setting must be maintained;
- Erosion and migration of the river channels is part of a naturally functioning and stable river system. In the long-term, vegetation such as cottonwoods and willows is integral this restoration;
- For the short-term (15-25 years) after reconstruction, structures will be relied upon to provide stability until the vegetation is mature. To the extent possible, structures will be similar to those naturally occurring in less altered sections of the rivers.

<u>1. Goal</u>: Improve water quality by reducing the erosion of contaminated sediments.

- Rock, wood, and vegetation will be used to construct instream, streambank, and floodplain structures mimicking natural structures found in other, similar Montana rivers; non-native biodegradable material may be used. (Measurement[2]: Material used is native or it is not, structure consistent with setting);
- Bank and in-stream structures installed to maintain channel and floodplain stability until vegetation has matured on the floodplain and streambank;
    - After the streambank and floodplain vegetation has matured (15 to 25 years) the channel and bank structures will have degraded allowing the river to migrate and develop channel(s) naturally across the floodplain (Measurement: Channel migration starts after vegetation has met ROD requirements and is structurally effective, monitor erosion rates, bed stability (aggradations/degradation) compared to reference reaches).

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[1] These goals and objectives were defined for the Draft Restoration Plan, April 2005. These goals and objectives will need to be refined further during the Final Design to reflect the monitoring that will be identified to measure the success of this project.

[2] Measurements are listed as potential guidelines for which goals and objectives will be measured. Examples of indices are listed as indices that could be used. Further refinement in the restoration planning and development of the monitoring and maintenance plan will discuss the indices that will be used.

2. Goal: Provide channel and floodplains that will accommodate sediment transport and channel dynamics appropriate for the geomorphic setting.

- Design parameters for the channel to allow the 1.5 to 2.0 year flood frequency to access the floodplain. Design of the floodplain, terrace, and wetland features will accommodate all levels of flooding consistent with setting. Channel and meander geometry will remain consistent over time. (Measurement: sediment is transported through restored reaches without excess aggradations or scour, channel hydraulic geometry remains within design criteria. Bank pins, cross-sections, and profiles will be monitored);
- Revegetation of the streambank and floodplain using a diverse community structure will be an integral part of the floodplain design (Measurement: ROD requirements met or exceeded)

3. Goal: Provide high quality habitat for all native fishes and other trouts, including continuous upstream and downstream migration while minimizing habitats that will promote undesirable fish species.

- Channel design will provide habitat features similar to reference conditions and consistent with stream type or geomorphic setting. Instream and bank structures will maintain habitat features until bank and floodplain vegetation matures allowing the geomorphic forces to create this habitat naturally. (Measurement: Goal 3 met thru achievement of Goals 1 and 2);
- To the extent practicable while restoring these large river systems, habitats favorable to northern pike or other potential undesirable species, e.g., shallow, slow, and warm water will be eliminated. (Measurement: northern pike spawning areas eliminated and not created)

4. Goal: Provide functional wetlands and riparian communities, where feasible. These communities will also provide improved riparian and wildlife habitat within the restored area.

- Wetland design will reference upstream and downstream wetland areas (Measurement: created wetlands with equal or higher ranking than exists in upstream or downstream wetland areas);
- Use of a diverse vegetation plan will improve wetland quality (Measurement: created wetlands with equal or higher ranking than exists in upstream or downstream wetland areas);
- A majority of the floodplain should develop into wetlands, but is dependent on groundwater elevations after dam removal. (Measurement: measure wetland areas).
- Revegetation activities proposed increase floodplain vegetation diversity and provide for long-term floodplain and channel stability. (Measurement: ROD, Appendix G)

5. Goal: Improve visual and aesthetic values through natural channel design, revegetation and the use of native plants and materials.

- The design will create a riparian zone that has a diverse vegetative cover (Measurement: vegetation ROD requirements met);
- The river channel design will function similar to reference sections (Measurement: channel maintains designed stream type and dimensions, see goal #1);

- Revegetation, floodplain, and channel design will consider other proposed land uses (Measurement: integration of other restoration projects considered to the extent practicable without compromising these Goals and Objectives).

6. Goal: Provide safe recreational opportunities compatible with other restoration goals, such as channel and floodplain stability, sediment transport, and fish habitat.

Establishing a naturally functioning system within the boundaries and limits present at the site are a priority; however, safety considerations will be evaluated with every aspect of the project. A totally safe river system cannot be built, rivers are inherently dangerous, and a system that is similar to other rivers in similar environments within Montana will be used to guide decision makers. (Measurement: Met goals 1 thru 5.)

To: Doug Martin, State of Montana NRD Program
Pat Saffel, Montana Fish, Wildlife and Parks

From: Christine Brick, for the Milltown Restoration Peer Review Panel

This document compiles and synthesizes the comments of the peer review panel for the *Draft Restoration Plan for Restoring the Clark Fork and Blackfoot River Following the Removal of Milltown Dam*, (DRP) of April 13, 2005 prepared for the State of Montana Natural Resources Damage Program and Montana Fish, Wildlife and Parks by Westwater Consultants, River Design Group, and Geum Environmental Consulting. The comments are based on the report itself, a site visit held on April 26, 2005, and presentations by the design team and partners. The reviewers are:

- David Biedenharn, PhD, PE, USACE, ERDC Environmental Laboratory
- Christine Brick, PhD, Clark Fork Coalition
- Craig Fishenich, PhD, PE, USACE, ERDC Environmental Laboratory
- William Trush, PhD, McBain & Trush, and Humboldt State University

Overall the panel felt that the designers did a good job addressing the challenges of such a complex project. The report is professionally presented and contains a wealth of engineering and geomorphic information. As the report itself states, the draft plan is a work in progress, and we hope these comments provide constructive advice for the next phase of the project.

Primary areas of concern with the project as it currently stands are the sediment transport analysis, proposed disturbance upstream of the Duck Bridge (particularly above station 130+00), design of grade control structures at and below the dam, and channel design methods based on a reference reach approach. One reviewer noted that, "Only adversative comments are provided. However, the absence of a comment on a particular subject should not be construed as endorsement of the methods or results." This holds true for all reviewer's comments. Overall, the reviewers agreed on key issues.

The reviewer's comments are arranged by topic, starting with general comments and followed by specific comments on the appendices. The outline of this document is as follows:

- Report Organization
- Project Goals and Objectives
- General Design
- Reference Reach Approach
- Overall Stability and Sediment Continuity Analysis
- Blackfoot River Response
- Design of Structures
- Additional Sediment Removal
- Construction Sequence and Riparian Restoration
- Comments on Appendices A, B, C, F, and G

Comments from the Peer Review Panel:
Draft Restoration Plan for Restoring the Clark Fork and Blackfoot River Following the Removal of Milltown Dam (2005)

Report Organization

The Draft Restoration Plan is lengthy and, while the organization is logical, it is difficult to follow the precise methodology used in arriving at the alternative designs. For example, the degree to which the analog, empirical, and analytical methods were relied upon for the final stable channel dimensions remains unclear. The report would benefit from a concise presentation of the methods employed, their results and the interpretation thereof, and the resulting recommendations. Much of the verbiage in both the main report and in the appendices could be characterized as background information intended to convey the designers' philosophies, and could be omitted or condensed and placed in a separate section. The main purpose of the report should be to describe the logical steps the designers took to design the channel.

The authors have referenced much of the related literature throughout the report, with citations listed in Appendix M, however there are numerous references in the report to unpublished data, with the citation generally credited to D. Rosgen. The accepted standard of practice is to include sufficient information to allow an independent reviewer to substantiate the verity of the methods and conclusions.

Project Goals and Objectives

The project objectives, defined for the Phase I effort, are in need of refinement. Each of the identified objectives should be described with a greater degree of specificity and include, where possible, quantifiable metrics and a reference to the time frame in which the objectives will be met. Executed properly, this effort should provide all stakeholders with a clear and consistent vision of the project, should guide design and construction decisions, and should serve as the basis for a monitoring plan to gage project success and identify maintenance needs. Section 1.2 states that the "overall goal is to restore the ecological and hydrological functions of the CFR and BFR…" However, the report fails to adequately identify and discuss these functions, and how the proposed plan will accomplish the goal.

In the Draft Conceptual Restoration Plan (2003), the State NRD Program listed its goals for the confluence:

1. Restore the confluence area of the Blackfoot and Clark Fork rivers to be naturally functioning and self-maintaining;
2. Use natural, native materials, to the extent practicable, for stabilizing channels, banks and floodplain;
3. Improve water quality by reducing the rate of release of contaminated sediments through bank erosion outside the area covered by the remediation plan;

4. Provide high quality habitat for fish and wildlife;
5. Improve aesthetic values in the area by creating a diverse, natural setting; and
6. Provide recreational opportunities such as river boating, fishing, and trail access for hiking and bicycling.

In the Draft Restoration Plan (2005) that is currently under review, specific objectives for each of these goals need to be defined so that in the short-term we can evaluate whether the plan will meet the objectives, and whether in the long term the project has succeeded or not.

For example, with respect to goals 1 and 3 listed above, while one goal is restoring the confluence to be naturally functioning and self-maintaining, another goal states that the river should not erode remaining contaminated sediments that will be left in place. Does this refer to the SAA-III sediments, the SA-IV & V sediments, or both? Although not extensively sampled, sediments in SAA VI & V are not as contaminated as lower in the reservoir; these sediments are coarser-grained and not as likely to be a threat to water quality. In discussions during the meeting on April 26th, 2005, the review panel was told that the channel through SAA VI & V could migrate "some, but not too much, and not right away." Limiting erosion potential during establishment of vegetation is understandable, but the rate of allowable erosion and channel migration needs to be better quantified. The potential threat of minor water quality impacts needs to be balanced against the long-term ecological benefits of a channel that is allowed to interact with its floodplain.

The monitoring and maintenance plan that will be prepared for the project should evolve from the effort to refine project objectives. This plan should (1) list specific performance metrics for the project and characterize the approved methods of measurement, (2) specify the frequency and timing of monitoring efforts, including seasonal-specific or event-driven monitoring needs, (3) outline the process for the review and assessment of monitoring data, and (4) show the approach for making decisions relative to maintenance or other remedial actions. The Draft Restoration Plan only partially provides the necessary guidance for a monitoring plan. The monitoring effort should be executed by an independent entity.

General Design

The proposed design consists of the removal of deposited sediments upstream of the Milltown Dam to reestablish the former floodplain elevation, the construction of a stable channel through the reconstructed floodplain, and revegetation of the exposed soils in the floodplain/terrace areas. The project, in conjunction with the remedial actions, is intended to limit exposure to contaminated sediments while also restoring the ecological integrity of the reach to a state approximating the pre-dam condition. The proposed design is reasonable in concept, but some specific details warrant further review.

The project limits should not extend upstream farther than is necessary to accomplish the project objectives. The current proposal includes floodplain and channel modifications extending to approximately Sta. 220+00, as shown in Appendix I. This proposal involves considerable channel and floodplain disturbance that does not appear necessary. The information furnished to the review panel does not justify extension of channel modifications upstream of Sta. 160+00, or of floodplain modifications (other than vegetation establishment) upstream of Sta. 130+00. Rather than reconstructing the upper part of the CFR3 channel (CFR3-B), it would be preferable to implement passive restoration by planting riparian vegetation, and possibly by adding temporary structures if necessary to help stabilize the channel until vegetation is established. This work could be done early in the construction sequence of the entire project, before other restoration work begins, and this would give vegetation a chance to become established as soon as possible. This would allow for natural channel function and stabilization with a minimum of disturbance in this reach.

The designers are concerned about how to connect the upstream end of the reconstructed channel to the downstream end of the existing unaltered channel. There are no easy solutions. The plan is to connect at approximately Station 200+00 on the profile. A seamless transition in floodplain slope would be desirable, but is not a requisite to a successful design. The Draft Plan proposes daylighting the floodplain (the reconstructed floodplain assumes the existing floodplain surface) at approximately Station 130+00 in Sheet I-3 (corresponding to Valley Station 120+00). Rather than connecting the reconstructed channel at Station 200+00 (in Sheet I-4), the connection could be made at approximately Station 135+00, possibly by using an armored pool tail grade control at Station 136+00. A low terrace could be created from Station 150+00 to Station 140+00 on the left (looking downstream) bankfull 'yellow' line and extended down to the left bankfull yellow line at Station 115+00. The proposed amplitude of the reconstructed meander from Station 135+00 downstream to Station 105+00 seems too large, given existing bends upstream (i.e., the amplitude in Alignment D Sheet I-6 seems best). Another alternative channel planform would be one of less amplitude in this meander, with the bottom of the full meander directed against the right bank (looking downstream) and possibly slightly upstream of Duck Bridge.

The panel has several questions regarding the development of the floodplain and terrace features in this transition reach. For example, given that the new floodplain must be excavated, does the existing floodplain surface become the low terrace once a new floodplain has been excavated? Must the 100-year terrace be extended out farther into the corridor? Couldn't a low terrace be created (or left) all the way to the existing 100-yr terrace? On the left valley corridor, once the floodplain has been excavated what does the original floodplain become? For example on Sheet K-8 Cross-section 105+00, the original surface from Station -700 to -1100 is now a low terrace? Why not have the low terrace 'move' farther out into the channel on the left side?

A map of inundation frequencies for each terrace feature would be important for channel design. Such a map can be created using relative bed surface elevations and riparian species associations. What is the inundation RI (annual maximum flood frequency

recurrence interval) for the low terrace? Most ‘true’ bankfull floodplains experience some deposition as maturing riparian vegetation encourages deposition. Are ‘floodplains’ with mature cottonwood stands being inundated by the 2-yr flood or greater? Much of CFR3 appears to make its way through aggraded floodplain and low terrace (another aggraded floodplain?), not simply through a flat floodplain just overtopped by the 1.5-yr annual maximum flood. Was this confinement considered in the channel stability analysis?

Information regarding the elevation, distribution and size of alluvium in the area to be restored is limited, or was not presented to the review panel. This information is necessary to formulate estimates of stable channel slopes and cross sectional dimensions. It would also provide insight into the ecological condition of the final project. We recommend that additional sediment borings be obtained in the vicinity of the proposed channel to acquire this information.

The current plan proposes to incorporate channel blocks on some of the existing side channels. We understand that the purpose of this is to (a) reduce the potential for channel avulsions, and (b) attempt to limit preferential habitat for northern pike (*Esox lucius*). It is not evident that either aim will be significantly met by blocking the side channels. The blockages may, however, limit access to these refugia areas under high flows, and could trap organisms under some circumstances. Side channels provide important habitat on these and other rivers in the region, and their functional elimination must be more thoroughly justified.

Reference Reach Approach

With the numerous watershed changes that have occurred over the past decades, and the dramatic changes that will result from the removal of the dam, we have some concerns about whether a reference reach approach is appropriate for this study. However, we understand the concept and are willing to accept its use here provided that the selected plan can be shown to meet the stability requirements and other project objectives.

The identification of suitable reference reaches for the design was understandably problematic. The designers appropriately noted that this required the integration of other empirical and analytical techniques to help determine appropriate dimensions for the channel morphology. However, the linkage between the analyses that were performed and the final design is not clearly represented. Furthermore, the report lacks an assessment of the performance of the selected channel design over a range of discharges.

The chosen reference reaches include CFR3-B and the Blackfoot near Ovando. CFR3-B could be a good choice because it has been subject to the conditions that the restored channel will also be exposed to, but it would be helpful to know why that short stretch has been “stable” at least since 1937. CFR3-B is a relatively short reach bounded on the upstream and downstream by braided reaches. This was explained in Appendix H by stating that “CFR3A and 3C exhibit the effects of watershed disturbance that has directly altered channel planform and gradient, increased sediment loading, reduced native

vegetation density, and confined the valley bottom". However, these impacts should affect CFR3B as well as the upstream and downstream reaches. This suggests to the panel that CFR3B may be more of an anomalous reach that is controlled by geologic controls or some other unknown factors and may not be an acceptable reference reach. As for using the Blackfoot as an analog: the report states that the reach is believed to be stable because it has moved at a rate that is "natural" for this channel. This rate should be described and compared to the existing condition on the Clark Fork. Is the sediment regime in the Blackfoot near Ovando (a river that flows through continentally-glaciated ground moraine) comparable to the Clark Fork?

The draft restoration plan presents four alternative channel alignments through CFR3, with the statement that they would be further analyzed in phase 3 of the project. However the DRP goes on to present an analysis for channel alignment C, which would involve substantial disturbance to the existing channel and floodplain, and with this, additional cost. This appears to be the preferred alternative, but if so, it needs to be justified. The increased cost of this alternative should be weighed against the increased risk of failure, and the increased ecological disturbance involved in reconstructing the channel. The apparent choice of alignment C is perplexing given that alignment D is closer to the sinuosity of the reference reach.

Given the above limitations, it is difficult to comment upon the selected channel cross-section dimensions. They appear to be reasonable, but should be separately assessed to assure that they provide the desired performance over the full range of expected flows. Of the proposed channel alignments, Alternative D (Sheet I-6) appears the most reasonable. The other alternatives not only involve more significant disturbance and cost, but also seek to create a channel that is more sinuous than casual observation would suggest as appropriate.

Overall Stability and Sediment Continuity Analysis

A significant issue with the Draft Restoration Proposal is the lack of detailed assessments to ensure that the proposed plans will have long-term sustainability with respect to sediment continuity and channel stability. Although Appendix C provides a preliminary stability assessment, this analysis is not sufficient to ensure that the proposed plans will meet sediment continuity requirements. We recommend a more detailed analysis of the proposed plans including a sediment continuity analysis. There is always significant uncertainty in sediment transport analyses on complex systems such as this, however, we believe that by conducting a more detailed analysis, some of this uncertainty can be reduced, and a better understanding of the potential channel responses can be achieved.

Appendix C provides considerable detail with respect to the sediment transport analysis that was conducted. However, this analysis needs to be expanded in order to more fully address the stability concerns. After discussions with the designers we understand that much of the additional information may already be available, and that some of these concerns could be addressed by a more detailed description of how the sediment transport

analyses were conducted. For instance, in Section C.6, more details are needed with respect to how the parameters (depth, slope, etc) used in the transport equations were developed (i.e., reach average values from HEC-RAS). It's also not clear which proposed alignment (A, B, C, or D) is being presented here. We assume that a separate analysis was conducted for each alternative alignment; the results from each of these should be shown to illustrate the varied responses. Also there should be some discussion about what bed material gradation was used for the areas that will be excavated. (Additional specific comments on Appendix C are provided in a later section of this report.)

Blackfoot River Response

Our concerns for the Blackfoot reach could be considered as part of the overall stability assessment needs, but because of the potential for significant infrastructure impacts in this reach, we believe that it warrants individual discussion. A more detailed stability assessment needs to be provided to ensure that the removal of the dam will not trigger channel degradation that could jeopardize the upstream bridges. The report mentions a cross vane weir at the Milltown Dam site, however, a more detailed analysis is need to clearly illustrate how this structure will provide stability through this reach.

Design of Structures

A discussion of, and justification for, the grade-control structures at the dam is lacking in the DRP. The plan needs a more detailed description of these proposed structures, and more discussion as to why they are necessary. The benefits of the proposed cross vane and W-weir in the vicinity of the dam are not evident. The profiles show these structures to be in a reach that is within the backwater of the riffle at the railroad bridge just downstream of the dam and, thus, may have insignificant influence on the water surface or energy grade. Because these structures entail considerable expense and represent a construction challenge (in terms of coordination with the remediation and dam removal), their benefits and performance should be further justified.

Our impression during the presentations was that the stabilization effort would include only the minimum number of structures needed to reduce the potential for catastrophic failure to acceptable levels. The intent would be to provide temporary stabilization until such time as the riparian vegetation could become sufficiently established to limit erosion rates to "natural" levels. We agree with this general philosophy. To that end, the panel recommends limiting the use of the cross vane, J-hook and other structures using boulders as a primary material as shown on sheets L-2 through L-5. A number of additional bioengineering techniques could be added to those shown in Appendix L. The engineered log structures shown on sheet L-1 could present a hazard to water-based recreation, and should be assessed for this concern.

Page H36 states that a rock sill is proposed at the upstream of CFR2 near Duck Bridge to ensure that the newly constructed floodplain remains secure until vegetation matures.

The vegetation is intended to stabilize the floodplain areas to protect against the channel shifting during high flows, while the grade control structure will control the bed within the channel. If an avulsion occurs and the channel cuts across the bare floodplain to a new location, then the grade control will be ineffective. If, on the other hand, the grade control is needed to prevent degradation from migrating upstream, then this need should be supported by the stability analysis. However, the current stability analysis indicates that the proposed channel is stable. If this is true, then theoretically there should be no need for grade control. Therefore, we suggest that more detailed description of the need and function of all grade control structures in the plan be presented. In particular, there needs to be a much better description of the proposed cross vane and W-weir at and just below the dam site, and how these structures will maintain the stability along the Blackfoot River.

The proposed grade control at the Duck Bridge location also needs to better described and justified. Other than stating that a large-rock sill will be buried 3 feet below floodplain elevation "approximately where the Duck Bridge fill is to be removed" the exact location and elevation of the structure is not provided. Will the sill extend all the way across the reconstructed floodplain at a constant elevation?

Duck Bridge is a prominent feature that considerably influences channel morphology. The Draft Restoration Plan calls for its removal, yet it has a pivotal location for potentially modifying the extent of head-cutting expected following dam removal, and the potential for channel avulsions in the reach. Could Duck Bridge be phased-out, pending the extent of head-cutting and the development of riparian vegetation, rather than removing it immediately and entirely?

Section 3.2.2.2 (page 3-9), states that each control structure will be designed to have no more than 0.5 to 1 foot of drop during base-flow conditions to allow fish passage. It's not clear that the proposed structures will meet this criterion over the full range of flow conditions. Rating curves and profiles should be provided for any proposed grade control structure.

The current plan proposes no structural control of the Deer Creek tributary, yet it appears that the bed at the confluence of Deer Creek and the CFR will be lowered about 7 – 8 feet. The channel may adjust by increasing its sinuosity (as shown on the plans), but is just as likely to simply degrade. If the latter occurs, the culvert under the road may become a problem for fish passage. Structures to provide a suitable grade to and through the road may be required. Because the site is easy to access, this could be implemented at a later date if warranted by the channel response and as indicated through monitoring.

Additional Sediment Removal

The EPA's Record of Decision will leave existing contaminated Clark Fork channel sediments (SAA III-b) in place within CFR2, just upstream of the dam. The Draft Restoration Plan will isolate these sediments with hard structures and with additional

floodplain and terrace contouring to make the steep bank appear natural. While the Draft Restoration Plan makes the best of this situation, we feel that the NRDP should spend the additional money to remove these sediments rather than designing the new channel around them. Removal has several advantages. First, the sediments may be a future source of groundwater contamination if the water table fluctuates through the lower-most part of the deposit, as previous groundwater modeling indicates possible. If this were to become a problem before the 5-year review of remedial actions, the sediments could theoretically be removed at a later date. But in reality, this would be impractical because the rail line into the reservoir is temporary, and channel restoration would have already begun. Removing sediments on the opposite side of the new channel would be destructive to restoration work already accomplished by that time. Second, removing these sediments allows the river more room through the confluence, and would allow for a less constricted floodplain and more natural channel function at and immediately upstream of the confluence in CFR2. It would allow more latitude in designing the channel gradient, and would potentially reduce the required number of rock-based structures in the river. Finally, although these sediments, if left in place, will be out of the 100-year floodplain, they are nonetheless directly adjacent to the river and not in a location where one would typically want to site a long-term waste repository. Removing them will benefit the long-term health of the river. We feel that the State NRD Program should re-evaluate the possibility of removing these sediments when the rest of the reservoir sediments are removed.

Construction Sequence and Riparian Restoration

The riparian restoration plan is thorough and appropriate. However, the proposed construction schedule would delay the planting of riparian vegetation until stage 3 (the third year). Because the project's ultimate performance presumably relies upon a healthy, mature and dynamic riparian system, areas largely unaffected by construction activities should be planted at the earliest opportunity to maximize root development and growth.

Appendix A. Hydrology and Flood Series

- The plan should include drainage areas at each gaged site (eventually found the DA's in Table A-50) in the figures.
- Figure A-1: The average annual hydrograph is always misleading. It would be better give examples of dry, normal, and wet annual hydrographs.
- The period of record at the Turah Bridge gaging station is too short for meaningful comparisons with the Blackfoot River.
- Bankfull estimates seem fine: in Table A-7 the doubling of Q from Q2 to Q10 seems a little strange (too high? short record?).

Appendix B. Existing Reach Conditions and Data Summary

Reach delineations (p. 2-13) for CFR3-A through C should be shown in the Appendix I plan view photos, using the stationing to define upstream/downstream boundaries of each. Appendix B addresses each sub-reach of CFR3 but it is difficult to know where each is located. Cross-sections should be located on the plan view photos as well.

Figure B-3 (p. B-12) is a "typical" cross section in CFR3-A, and Figure B-4, on the same page, is the longitudinal profile of Reach CFR-A. The X-axis for Figure B-3 seems to be in relative feet (not ft as shown) and the X-axis in Figure B-4 seems to be in ft (and not relative ft as labeled). This makes cross-referencing and comparison of cross-sections to the longitudinal profile very difficult.

The cross-sections have an undisclosed water surface elevation and bankfull elevation, but no other flood levels associated with other prominent features (e.g., the flat surface beginning at Station 350 ft in Figure B-7 (p. B-17). Were known stream flows surveyed on cross sections but not reported in the Draft Plan? These depositional features contribute confinement at flood flows, and are likely partly responsible for the single-thread characteristic at this location. Is this surface inundated by a 10-yr flood or 50-yr flood? Floodway reconstruction should entail more than designing the 'bankfull' floodplain, but include low terrace features, and possibly side-channels and abandoned main channels as well. Cross-sections need to provide this perspective. Is the side-channel flowing at Station 325 ft during a 3-yr flood (flow entering from upstream, rather than overtopping the hump at Station 275 ft)? Will a 5-yr flood overtop this hump?

What does Bank Integrity (using BEHI) get us? The 'H' in BEHI implies (in fact states!) a negative impact from bank erodibility. Yet a very healthy stream has eroding banks. How would this healthy stream compare? A comparison of BEHI values between CFR3-B (Figure B-9) and CFR3-A (Figure B-5) substantiates that CFR3-A has poor bank integrity only if CFR3-A 'should' be like CFR3-B. The historical photographs (since 1935) don't seem to indicate this. Instead, E-8 Historical Aerial Photo Analysis 2000 Series shows a previously unconfined floodway halved (or more) by the railroad line upstream, then the mainstem channel entering the unconfined floodway of CFR3-A. The plan does not provide a convincing argument that CFR3-A was once like CFR3-B.

Appendix C. Preliminary Channel Stability Assessment

What is 'channel stability?' The Draft Plan never really says. What are the units for channel stability? What threshold values indicate non-stability? In the main text (p.3-3) stability is defined as a dynamic equilibrium between sediment supply and streamflow. In Appendix C stability seems to be a stable slope. The main text and introduction for Appendix C should both spell-out what stability means and how it is to be quantified, including thresholds for channel design.

Page C-18 states that "Table C-7 summarizes sediment continuity analysis through a comparison of average sediment transport rates (all methods) for the selected reference reaches and proposed design reaches." However, it's not clear what "average of all methods" means. Taking the average value for the three sediment transport methods is not acceptable. A more appropriate approach would be to show the results for each method, or to select the one that best represents the channel system and show only those results. It is important to estimate the uncertainty in this analysis in order to understand the range of potential outcomes. This can't be accomplished using an "average of all methods" or even by comparing the results of different methods. The real issue is the uncertainty in estimating input parameters, and the strong nonlinearity of the equations where small changes in poorly known boundary conditions result in large changes in the results. Thus the approach should be to choose one or more methods that best characterize this channel system, estimate the distribution of each parameter based on field data wherever possible, then model the range of uncertainty with a Monte-Carlo simulation. The resulting distribution gives an estimate of cumulative transport, as well as an idea of the range of values. Ultimately this is more useful for design than a range of values derived from different methods. (See Wilcock, P.R., 2004, Sediment Transport in the Restoration of Gravel-bed Rivers, Proceedings of World Water Congress, ASCE, available on the web at http://www.usu.edu/awer/pages/Shortcourse/WilcockFinalEWRI2004.pdf, and also Wilcock, P.R., 2001, Toward a practical method for estimating sediment-transport rates in gravel-bed rivers, Earth Surface Processes and Landforms 26: 1395-1408)

The report implies that more stability assessment is planned. Could a few sets of painted rocks (D_{50} and D_{84}) (prior to the snowmelt peak) be placed on uniform bar features in CFR3 to test whether the shear stress modeling really does work? A few other sets in hydraulically complex locations (e.g., at side-channel entrances and braided lateral bar features) that are difficult to model could really provide insight not gained by the models. Despite the inherent difficulties in bedload sampling, some attempt should be made to get field estimates for this parameter. A discussion of bedload sampling strategies can be found in the Wilcock reference listed above.

Table C-7 combines sediment transport rates for the CFR3 Reference and BFR1 Bonner Gage Reference and then compares that to the CFR1 Bandmann Reference reach for existing conditions. This seems to ignore the lower end of CFR3 and CFR2. Therefore, it's difficult to understand what the significance of these values is. Also, in Table C-7, under the Proposed Design Conditions, there is a proposed CFR3/2 rate of 53,652. It is not clear where the value of 53,652 came from. Presumably this is an average for CFR3 and CFR2, but we can't calculate this value.

The sediment transport analyses do not provide a clear picture of the sediment continuity through the project reach. Transport relative to reference reaches provides little insight into the performance of the project. A more meaningful analysis would provide, at a minimum, a sense of the sediment transport capacity upstream of, through, and downstream of the project reach. Assuming the bed materials are similar throughout, a simple plot of stream power or shear stress from the Turah Bridge to the USGS gage

downstream of the project would suffice to identify potential problems associated with aggradation or degradation. This analysis should be repeated for a range of discharges in excess of a threshold condition for the D_{50}, and should incorporate varying inflows from the Blackfoot River.

Figure C-9 shows the results of the sediment transport continuity analysis. This analysis generally shows that sediment continuity will exist throughout the project area under project conditions at the bankfull condition. While this type of analysis can be revealing, it does not capture the effects of the duration of the range of flows. Therefore, we recommend calculating the sediment transport capacity for the entire range of flows and integrating this with the flow duration curve to estimate the potential for scour or deposition on an annual basis for each reach. We also recommend breaking the reaches down into smaller reaches. This analysis should be conducted for all four alternatives.

There are several inconsistencies and errors in the technical presentations in the main report and appendices. These may not have influenced the final design (note previous comments), but should be addressed. Examples include the following:

- The Meyer-Peter and Muller formula for sediment transport is inappropriately applied on page C-3.
- The assessment of resistance coefficients on page C-6 is circular and incorrectly applied.
- Bray's regime relation (page C-9) should use the Q_2, not Q_{bf}.
- The Simons and Albertson relation on page C-10 is for metric units, but was applied using English units.
- Several parameters associated with the Millar regime relations (page H-10) are deemed dimensionless when they are, in fact, dimensional, and the equations themselves do not make physical sense (are width and depth directionally proportional to d_{50}??)

Appendix F. Fisheries and Wildlife Resources

- Will the Deer Creek culvert be replaced/designed for cutthroat trout?

- Old meander bends (often referred to as wetlands) connected to flow in the mainstem (i.e., not just during peak flow events) will likely behave very differently than those that are isolated (e.g., those on the wrong side of the old railroad grade). The Draft Plan seems to consider that a plugged side-channel will continue functioning the same. While the desire to keep pike out of the mainstem is important, these remnant mainstem features provide a lot of the habitat diversity within the floodway. Isolating many of these could greatly reduce wetland diversity and quality.

Appendix G. Vegetation and Wetlands Analysis

- Page G-8, Paragraph 5: The organic mulch may be a prospective source of non-native invasive plant seed depending on the source of this material, and should be investigated.

- Page G-9, Section G.4.2. Pruning the tops of salvaged trees to be equal to the root ball in size may improve transplanting survivability.

- Pages G- 9 and 10: Geomorphic features are classified as streambanks, floodplain, wetlands, and uplands. A greater diversity of geomorphic features could have been targeted for associating riparian species and community types, including emerging point bars, aggraded floodplains, aggraded oxbows, low terrace, and other terraces. The planting strategy (pp. 3-10 to 3-13) mentions micro-diversity of substrate patches, but should consider a macro-diversity related to these other geomorphic features.

- Water levels in the proposed wetland areas should be investigated prior to planting to ensure that these areas remain sufficiently wet for wetland vegetation. At this point, the future configuration of the water table with respect to the river is unknown, and while the plan assumes that the water table will be high enough to maintain wetlands, this isn't known with certainty.

- The plan should consider and predict likely changes in the riparian community if side-channels are isolated from mainstem flow and inundated only during occasional peak flows.

- Page G-16, Section G.4.7. Red Osier Dogwood (*Cornus stolonifera*) and alder (*Alnus incana*) are also available on site and these plants will root adventitiously from cuttings by using the same methods as mentioned for the willow species.

- Page G-21, section G.4.9. There are 3 bioengineering techniques proposed but only two methods are described; need to add a description of pre-fabricated vegetated gabions.

- Page G-22, section G.4.14. In areas with invasive plant growth you should consider herbicide spot treatments by trained personnel rather than "starting over", which could quickly become an expensive proposition.

- An aggressive plan for combating weed invasion, though somewhat vague at this point (it consists mostly of listing options) is important. How well have these listed strategies worked locally?

- Page G-25 and G-27, Tables G11 and G-12: Could consider live-staking as another bioengineering method using on-site vegetation, particularly in the floodplain where there are no bioengineering treatments being proposed.

THE STATE OF MONTANA'S RESPONSES TO PEER REVIEW ON THE *DRAFT RESTORATION PLAN FOR THE CLARK FORK RIVER AND BLACKFOOT RIVER NEAR MILLTOWN DAM* (April 2005)

Introduction

On April 26, 2005, the State of Montana provided for comment its *Draft Restoration Plan for the Clark Fork River and Blackfoot River Near Milltown Dam (DRP)*. This plan was prepared in consultation with two other natural resource "Trustees," namely, the U.S. Fish and Wildlife Services (USFWS) and the Confederated Salish and Kootenai Tribes (CSKT). The State requested the DRP be reviewed and written comments be submitted by a panel of experts in the fields of geomorphology, engineering, fisheries, and geochemistry. Representatives of Missoula County and ARCO were also welcome to comment; only Missoula County submitted written comments. Where Missoula County's comments and the peer reviewers comments both address the same issue we have tried to include both parties. Missoula County had additional comments that are responded to in a separate summary. As noted in some of the State's responses, additional discussions with the peer review members are warranted to resolve uncertainty about the DRP and peer review comments.

A copy of the peer reviewer's comments is attached to this responsiveness summary. The peer review members provided individual comments as well as a summary of their comments, which all peer reviewers approved. This responsiveness summary addresses the comments from the peer review summary of comments. The State believes that the summary of comments put together by the peer review panel captured the comments written by individual panel members.

The comments received have been numbered so that the various comments relating to the same topic to which the State is responding can be readily identified. Similar comments are listed and addressed together; other comments are listed and addressed individually. Most comments are paraphrased; however, the page and paragraph where the comment can be found is provided to allow the reader to view the entire comment. The State's responses to the comments indicate what changes, if any, that the State will make to the *DRP* and/or when the change might be incorporated into the restoration planning process.

Comment 1: DRP Organization. Page 2, paragraph 1: The peer reviewers and the County commented that the DRP's length and organization made it difficult to follow the methodology used to arrive at the alternative designs.

Response: The State recognizes this comment. The State does not propose to spend the time or resources to rewrite the DRP to address this comment. This comment will be considered in the drafting and development of future documents.

Comment 2. Reference Citation Standards. Page 2, paragraph 2: The peer reviewers noted that references to unpublished data was inadequate and asked that sufficient information be

presented to allow an independent reviewer to substantiate the verity of the methods and conclusions.

<u>Response</u>: Reference to Rosgen publications will be clarified to cite the exact document rather than “unpublished data”. Because the methods are often times similar to other researchers’ techniques, other publications will also be cited where appropriate. Copies of the referenced Rosgen documents can also be included in the final report or available on a website if requested.

<u>Comment 3: Goals and Objectives. Page 2, paragraph 3</u>: The peer reviewers and the County commented that the goals and objectives presented in the DRP need to be updated to include enough data that the goals can be measured to determine if the project is successful. The County recommended adding goals for public safety and structural stability.

<u>Response</u>: The State agrees with the comment that the goals and objectives need to be revised. A new set of goals and objectives is attached.

<u>Comment 4. Project Monitoring Plan. Page 3, paragraph 3</u>: The monitoring and maintenance plan that will be prepared for the project should evolve from the effort to refine project objectives. This plan should: (1) list specific performance metrics for the project and characterize the approved methods of measurement; (2) specify the frequency and timing of monitoring efforts, including season-specific or event-driven monitoring needs; (3) outline the process for the review and assessment of monitoring data; and (4) show the approach for making decisions relative to maintenance or other remedial actions. The Draft Restoration Plan only partially provides the necessary guidance for a monitoring plan. The monitoring effort should be executed by an independent entity.

<u>Response</u>: A quantitative monitoring plan based on standard methods will be developed during Phase 3. The monitoring will evaluate the projects goals; channel morphology, structure stability, vegetation condition, and fisheries. The monitoring plan will also include State monitoring requirements identified in the CD. Appropriate goals and objectives will be established with measurable metrics that will be developed in order to determine if the project meets the presented goals and objectives in the future. Monitoring will be coordinated between the State, USEPA, Settling Defendants, and the designing consultants. The State does not believe that an independent entity should conduct the monitoring; however, independent entities will be able to review and comment on the monitoring data that is collected.

<u>Comments 5 and 6. Upstream Project Limits and Upstream connection. Page 4, paragraph 2</u>: The project limits should not extend upstream farther than is necessary to accomplish the project objectives. Rather than reconstructing the upper part of the CFR3 channel (CFR3-B), it would be preferable to implement passive restoration by planting riparian vegetation, and possibly by adding temporary structures if necessary to help stabilize the channel until vegetation is established. This work could be done early in the construction sequence of the entire project, before other restoration work begins, and this would give vegetation a chance to become established as soon as possible. This would allow for natural channel function and stabilization with a minimum of disturbance in this reach.

Response: This response addresses the main points of comments 5 and 6; however, there is some overlap with comments 7, 10, 15 and 40 relative to the selected alignment and floodplain/swale treatments.

The upstream limit of the CFR3 floodplain reconstruction in the DRP is between Stations 135+00 to 142+00 in the river stationing (Appendix Sheet I-3). This upstream limit is the point at which the floodplain grade "daylights" out to the existing surfaces as shown on sheet J-2, which occurs at Station 120+00 to 125+00 on the valley stationing. As discussed in Comment number 15, the designers have concluded that Alternative Alignment D is the proposed alignment, which uses the existing channel system. Alignment C will be carried forward as the alternative alignment. Both alignments will undergo a stability assessment as well as review by the involved landowners.

If Alternative D remains as the preferred alignment, minimal work will be done upstream from the floodplain reconstruction limit. The designers did not specifically locate and identify individual structures and treatments in the Reach from Station 160+00 to Station 220+00 (Figure I-4) for this DRP. However, our proposed action is consistent with the peer reviewers recommendation of vegetation planting and short term (temporary) wood based structures to stabilize streambanks and improve the riparian corridor. The designers still feel strongly that channel and floodplain in the reach between 140+00 and 160+00 needs to be re-shaped and stabilized with similar structures to connect the downstream reach with the more stable reference reach. The existing channel in this area is braided and relatively unstable. The peer reviewer's comment about placing an armored pool tailout structure and low terrace would not be adequate to prevent lateral migration and braiding of the channel in the short term until vegetation can become established. Indeed, design teams experience with using a single structure to connect or start a project in an unstable reach would suggest that this approach would result in channel aggradation, braiding and failure to meet the project objectives.

The designers will limit the upstream work to Station 220+00 (Appendix Sheet I-4) for the purposes of the final restoration plan. However, the designers recognize that leaving the river untreated upstream from that point imparts risk that the channel will enter the project at some other location or angle that would be detrimental to the long term stability of the project area. Also, bedload sediment sources from the reach upstream would remain high with no additional restoration work upstream from Station 220+00. Performance and stability assessment of the final selected alignment will be conducted in the Phase 3 design process. This assessment, considering the existing unstable conditions remaining upstream, will provide some quantitative determination of the long-term risks. The final restoration plan will summarize this determination.

Channel alignment details and floodplain, terrace and channel interaction will be discussed in responses 15, 7, 10 and 40 respectively.

Comment 7. Floodplain/terrace features. Page 4, paragraph 3: The peer review panel has several questions regarding the development of the floodplain and terrace features in the lower transition reach of CFR3. For example, given that the new floodplain must be excavated, does

the existing floodplain surface become the low terrace once a new floodplain has been excavated?

<u>Response</u>: At the time of the DRP development, many factors were in draft stage, including preferred alignment, proposed floodplain grade, etc. Because of the uncertainty, a highly detailed floodplain and terrace surface was not proposed for CFR 3. In CFR 2, due to the necessity of integrating with remediation, much more time was spent on the grading plan and the floodplain/terrace/wetland depressions. However, the concept for the floodplain/terrace/wetland surfaces for CFR 3 is similar to that for CFR 2 (Sheet I-2). The designers' goal is to incorporate a low terrace that would be inundated at about the 10 to 25 year return interval flood, but have semi-connected wetlands within the floodprone area. The concept discussed in the DRP provides a gradual transition in floodplain or floodprone width from over 2000 feet to less than 1000 feet over a 3000-foot linear distance to minimize backwater effect that would affect sediment transport during large floods. A detailed floodplain and terrace surface will be developed in Phase 3 after the proposed alignment and grade are selected.

In general terms, for the portion of Reach 3 where the floodplain will be excavated and inset (Figure I-3, from Station 140+00 to 100+00 +/-), the existing floodplain will transition from a floodplain to a low terrace to a high terrace proceeding in a downstream direction. The final restoration plan will include a more detailed discussion of the design concepts for the floodplain and terraces in CFR 3. The Phase 3 final design will provide the details for the transitions and floodplain/terrace/wetland interaction.

<u>Comment 8. Inundation Frequency. Page 4, paragraph 4</u>: A map of inundation frequencies for each terrace feature would be important for channel design. Such a map can be created using relative bed surface elevations and riparian species associations. What is the inundation RI (annual maximum flood frequency recurrence interval) for the low terrace?

<u>Response</u>: Mapping of terrace feature elevations and inundation frequencies will be completed in Phase 3. Due to the extent of proposed excavation in Milltown Reservoir, reach CFR2 is the only reach for which the inundation frequency of terrace features can be designed. Criteria for this effort will rely on terrace plant species and subsequent rooting depths from the vegetation assessment, and floodplain width requirements from the channel stability analysis. Since existing channel and floodplain features will remain at the same elevation in other reaches, terrace features will interact with flood events in a manner consistent with existing conditions.

Although many depositional features are present in reach CFR3, existing topography confirms that during discharges greater than bankfull, the river has access to a broad floodplain and several side channels that prohibit lateral confinement. Please refer to cross sections 120+00 and 150+00 on sheet K-8 in Appendix K.

Refer also to response items 7, 10 and 40 for related discussion.

<u>Comment 9. Alluvium Sizes. Page 5, paragraph 3</u>: Information regarding the elevation, distribution and size of alluvium in the area to be restored is limited, or was not presented to the

review panel. The panel recommends that additional sediment borings be obtained in the vicinity of the proposed channel to acquire this information.

Response: Sediment core information was collected by the Settling Defendants in Remediation Project Area over several years. However, core samples in the CFR 3 area were limited to a few samples. The lack of data in the area upstream from Duck Bridge was recognized as a limiting factor in the design and additional supplemental core data was collected at 27 sites in July 2005 to determine distribution and contamination of sediments. This data will be utilized in the Phase 3 design for CFR 3.

In general, the previously available core data were used to establish the elevation and location of pre-dam alluvium. That information was used to validate the proposed longitudinal profile of the proposed channel through CFR 1 and 2. Most of the proposed channel would be excavated into this pre-dam alluvium. Unfortunately, the size distribution of this alluvium is limited to a few samples due the method used for collecting the samples. However, the assumption was made that if the alluvium were deposited by the natural channel regime before the dam was in place; it should be suitable as a basis for the channel bed. The existing information will be used in the Phase 3 design to assess channel stability. The exact composition of the alluvium will be determined during the sediment excavation phase of Remediation and final designs will be modified to account for the final sediment distribution. The designers may supplement the native alluvium with screened coarse bed material obtained during construction to further stabilize the riffle segments if necessary in the short term.

Comments 10 and 40. Floodplain and side channel blocks/plugs. Page 5, paragraph 3, Page 12, paragraph 6: The current plan proposes to incorporate channel blocks on some of the existing side channels. The blockages may, however, limit access to these refugia areas under high flows, and could trap organisms under some circumstances. Side channels provide important habitat on these and other rivers in the region, and their functional elimination must be more thoroughly justified. While the desire to keep pike out of the mainstem is important, these remnant mainstem features provide a lot of the habitat diversity within the floodway. Isolating many of these could greatly reduce wetland diversity and quality.

Response: The designers agrees with the peer review panel's description of the value of the side channels, abandoned oxbows, ponds and floodplain swales and the role these features play in providing stream corridor habitat diversity. The rationale for plugging the swales near the features' confluence with the main stem channel, as the review panel identified, is to limit the amount of pike spawning and rearing habitat in the project area. This concept will be reviewed in light of the importance of these features to aquatic habitat diversity. If the ecological value of maintaining connectivity with these floodplain habitats is more valuable than limiting pike habitat, then plugging these features may not be prudent. This issue will be further addressed in Phase 3.

The DRP did not effectively articulate the proposed actions and thought process well enough in relation to the side channels and swales. For the Phase 2 DRP, the design objective was that the majority of channel plugs or filling would occur only where an existing active channel would be reshaped to meet the proposed design. Most off-main channel swales and side channel would

remain intact. The side channel or swale would only be plugged or filled if it posed a large risk to the integrity of the project. The intersection of the side channel and the main channel floodplain or terrace will be evaluated on a case-by-case basis to minimize disturbance to the side channel and ensure floodplain stability in the short term. This additional detail will be included in the final restoration plan.

Comment 11. Relation of reference reach data to the design. Page 5, paragraph 5: With the numerous watershed changes that have occurred over the past decades, and the dramatic changes that will result from the removal of the dam, the panel has some concerns about whether a reference reach approach is appropriate for this study. However, the panel understands the concept and is willing to accept its use here provided that the selected plan can be shown to meet the stability requirements and other project objectives.

Response: The proposed design is a culmination of analog, empirical, and analytical methods analyses. Reference reach data formed the foundation of the analysis since the data were modeled using analytical methods and applied to empirical equations investigating channel morphology characteristics. The analog method provided the foundation for the design. Analytical techniques tested and fine-tuned the preliminary dimensions developed from the analog method. Empirical equations incorporating the reference reach data validated the proposed design channel plan form as well as presented a range of potential channel cross-section design dimensions. Additional explanations regarding these topics may be found in response to comments 12 and 32.

Analog, empirical, and analytical methods used to evaluate existing channel conditions were also used to predict the likely historical plan form morphology of the Clark Fork River upstream from the Blackfoot River confluence. First, the selected reference reaches (river reaches perceived to be in a stable state) were surveyed to evaluate existing conditions. Existing channel conditions (river reaches that have departed from the perceived stable state) were modeled using analytical methods to investigate channel hydraulics and sediment transport. Channel cross-sections surveyed on reference reaches and existing condition reaches from both the Clark Fork and Blackfoot rivers were modeled in HEC-RAS. Modeling results were compared to determine channel departure from perceived stable state conditions.

Secondly, the reference reach data were used to develop a range of design channel dimensions for the project area. Analytical techniques (e.g. HEC-RAS models, Shields equation) were used to evaluate channel conveyance, hydraulic roughness, and sediment transport. Reference data were also entered into empirical equations used to predict likely sediment transport, channel cross-section, slope, and plan form attributes.

Third, the reference data provided the basis for evaluating the likely historical and potential future channel plan form dimensions in the project area. Empirical equations developed by Wolman and Leopold (1957) and more recently by Millar (2000; 2005) were used to address the likely historical plan form of the Clark Fork River upstream from the Blackfoot River confluence. Reference reach data that were used in these equations included channel cross-section dimensions, the bankfull channel slope, sediment particle size information, and riparian vegetation conditions.

The final restoration plan will be edited to reflect this additional detail.

Comment 12. Final Dimensions and Performance over Range of Discharges. Page 5, paragraph 5: The report lacks an assessment of the performance of the selected channel design over a range of discharges.

Response: Final channel dimensions were established through a trial and error process that included several iterations of channel stability analyses. The methodology focused on refining the design dimensions until acceptable values were observed for each parameter identified in Appendix C – Preliminary Channel Stability Assessment. For reporting purposes, only the final iteration of analyses was reported in Appendix C.

An assessment of the selected channel dimensions over a range of discharges was completed using HECRAS; however, it was omitted from the DRP. The summary output from this analysis is presented herein in Attachment A and will also be included in the final restoration plan. Hydraulic parameters derived from the analysis were used as input for calculations presented in the channel stability assessment.

Comment 13. Reference Reach Selection. Page 5, paragraph 6: The chosen reference reaches include CFR3-B and the Blackfoot near Ovando. CFR3-B could be a good choice because it has been subject to the conditions that the restored channel will also be exposed to, but it would be helpful to know why that short stretch has been "stable" at least since 1937.

Response: The CFR3-B reach, while short in length, has remained a relatively stable meandering channel over at least the last 70 years. The reach upstream differs because of the encroachment of the floodplain and direct straightening, bank hardening and manipulation due the railroad corridor. The reach downstream is directly affected by the backwater deposition of the dam during the 1908 flood. Our detailed analyses (DRP Sections 2.4, Appendix B, D and H) indicate that the CFR3-B reach is one of the best reference reaches available and when combined with the other analyses performed, is suitable for design purposes. Our analyses indicate that CFR3-B reach is not an anomaly in the system, but rather one of the last relatively healthy remnants of the historical system. No changes will be made in the documentation of the CFR reference reach.

Comment 14. BFR Ovando questions. Page 6, paragraph 1: As for using the Blackfoot River as an analog, the report states that the reach is believed to be stable because it has moved at a rate that is "natural" for this channel. This rate should be described and compared to the existing condition on the Clark Fork. Is the sediment regime in the Blackfoot near Ovando (a river that flows through continentally-glaciated ground moraine) comparable to the Clark Fork?

Response: The initial purpose of the BFR reach survey was to determine how a valley with similar morphology transitions from a broad, less confined system to a confined canyon in terms of floodplain width, gradient and channel characteristics. Undisturbed river/valley systems suitable for valley morphology design are also lacking in western Montana. Because of its similarity to the CFR system and generally undisturbed, stable functioning condition, additional

data were collected and used in the design process. The Blackfoot River reference reach is similar to the CFR in terms of hydrology, bedload sediment transport, valley and channel morphology and climate. Differences between the CFR and BFR are mostly in land use and development, but also include parent material, landform processes, and sediment supply. While not a "perfect" reference for the CFR system, due to the lack of reference reaches in the area, the designers felt it is suitable for design purposes.

Sediment transport characteristics were summarized and displayed as a comparison with the CFR. Sediment supply has not been determined nor has the lateral migration (bank erosion rates) due to lack of time and budget. However, bed scour chains were installed and will be monitored in 2005 and 2006 and will be compared with scour data from the CFR reaches. No additional analyses will be completed on the BFR Ovando reference reach and the restoration plan will not be revised in reference to this reach.

Comment 15. Alignment Alternative Selection. Page 6, paragraph 2 and 3: The DRP presents four alternative channel alignments through CFR3, with the statement that they would be further analyzed in Phase 3 of the project. However, the DRP goes on to present an analysis for channel alignment C, which would involve substantial disturbance to the existing channel and floodplain and, with this, additional cost.

Response: The DRP addresses the rationale for developing the four alternative alignments. In summary, the alignments were based on the design criteria, historical photos and alignments and existing limitations and infrastructure. None of the alignments were developed using "casual observation". One important step missing from the evaluation of any of the alignments is the review of the proposed alignments and comments of the landowners. Of the four alignments, Alternative C best fits the design criteria and historical channel traces. However, after further discussion with the designers, Trustees, and peer reviewers, alignment D appears to best meet the objectives of the restoration plan. Thus, alignment D will be the preferred option and alignment C will be continued in the evaluation and compared with alignment D as discussed in response to comments 16 and 17. The designers will also present the two alternatives to the landowners and seek comment. The final selected alignment may differ somewhat from the proposed alignments.

Comment 16. Need for a More Detailed Channel Stability Assessment. Page 6, paragraph 4: A significant issue with the DRP is the lack of detailed assessments to ensure that the proposed plan will have long-term sustainability with respect to sediment continuity and channel stability.

Response: It is understood that the preliminary channel stability assessment offers a simplified approach toward gaining an understanding of how the proposed channel will function. The analysis is based on the results of one-dimensional hydraulic models developed for typical channel/floodplain cross sections experiencing uniform flow conditions. It is also understood that a more detailed analysis will decrease uncertainty, and thus, an objective of Phase 3 is to incorporate detailed design topography into the hydraulic model and further refine the stability assessment.

An objective of Phase 2 was to validate and refine the proposed channel and floodplain dimensions based on reference reach data, existing sediment data and existing site data. The designers' opinion is that the preliminary channel stability assessment took advantage of the best available assessment methods and accomplished this objective. The conclusion reached through the preliminary channel stability assessment was that the proposed channel dimensions would provide an acceptable level of channel stability to allow the designers to proceed toward final design using the draft concept.

Comment 17. Questions about Stability Assessment. Page 6, paragraph 5: Appendix C provides considerable detail with respect to the sediment transport analysis that was conducted. However, this analysis needs to be expanded in order to more fully address stability concerns.

Response: As discussed in response 12, supporting information for the channel stability assessment is included herein in Attachment A. Response 32 through 37 provide a more detailed discussion about the sediment transport analysis.

Upon release of the DRP for peer review, alignment C was the preferred alternative. Therefore, the stability assessment for proposed conditions was conducted on alignment C. However, recent consideration of peer review and further analysis has generated support for alignment D, which will receive further consideration in Phase 3.

Except for CFR2, bed gradations in the proposed reaches are assumed to be consistent with corresponding reference reach data. CFR3B was assumed to be representative of CFR3 and CFR2. Proposed bed gradations for reconstructed reaches will be established in Phase 3 design. It is anticipated that during construction on-site alluvium will be screened to compose size classes that resemble reference bed gradations and meet channel stability criteria. Please refer to response 9 for additional discussion related to this topic.

Comment 18. Blackfoot River Response. Page 7, paragraph 2: The peer reviewers concerns for the Blackfoot reach could be considered as part of the overall stability assessment needs, but because of the potential for significant infrastructure impacts in this reach, they believe that it warrants individual discussion. A more detailed stability assessment needs to be provided to ensure that the removal of the dam will not trigger channel degradation that could jeopardize the upstream bridges.

Response: It is understood that a more detailed stability assessment needs to be provided to ensure that the removal the dam will not trigger channel degradation that could jeopardize the upstream bridges. Mitigation of impacts to infrastructure is a remedial action responsibility and is being addressed by EPA and others. Efforts to coordinate Remedial Action with Restoration and develop a solution are outlined in the CD. However, more detail will not be available until Phase 3 is complete.

Please refer to responses 19 and 20 for additional discussion related to this topic.

<u>Comments 19 and 20. Proposed Structures and comments. Page7, paragraph 3 and 4</u>: The plan needs a more detailed description of these proposed structures and more discussion as to why they are necessary.

<u>Response</u>: With few exceptions, the proposed location and type of needed structures would be completed in the Phase 3 design. Due to the concerns regarding grade control in relation to the infrastructure and dam removal as well as the need for more detail relative to the Consent Decree, two specific structures were proposed at the location of the dam and just downstream. These structures were proposed in preliminary design format in order for the Settling Defendants to plan the Remediation Actions in the vicinity of the dam. As discussed in the DRP, the purpose of these structures is to stabilize the streambed and streambanks in vicinity of the dam. The final selected grade control structures at the dam location may need to be constructed several years before the channels upstream will be completed due to the Remediation schedule. The structures are a minor cost when compared to the project costs. However, the risks of channel scour are very significant as are the potential increased project costs if bed degradation were to occur in this reach. These structures are intended to be temporary in nature until the entire bed undergoes natural sorting and armoring processes. The proposed rock structures are consistent with the morphology of the CFR in this reach (near the bedrock outcrop).

The riffle downstream from the dam (upstream from the railroad grade) is not an adequate grade control and will not provide the "backwater" effect necessary to stabilize the grade. The existing scour pool tailout referenced by the review panel is formed by a channel configuration that will no longer be in place. The scour pool exists due the hydraulics created by the spillway and radial gate, which will be removed. The pool downstream from the powerhouse was created by releases through the turbines. The existing pool tailout is created by complex hydraulics associated with the two release points and dam operation. The proposed plan would reshape the entire area, which will change the existing pool tailout referenced by the Review Team. The existing pool tailout is not adequate to ensure grade control upstream, and thus, some grade control structures will be necessary in this reach of river.

More evaluation and discussion of these structures will be completed in the Phase 3 analysis. Different types of structures will also be evaluated during the Phase 3 design. Further discussion with the review panel about other options to the structures proposed may be beneficial.

<u>Comments 21 and 22. Duck Bridge Grade and Sill Questions. Page 7 and 8, paragraph 5 and 1</u>: The proposed grade control at the Duck Bridge location also needs to better described and justified.

<u>Response</u>: The rock sill at the Duck Bridge was proposed as a floodplain grade control to limit potential scour of the floodplain during over-bank flows until the floodplain vegetation can become established. The designers believe that floodplain grade control is needed to resist floodplain erosion caused by flow acceleration generated by the proposed floodplain slope break and gradual floodplain constriction beginning at Duck Bridge. The details of the proposed sill will be determined in the Phase 3 design, but the concept would be to bury rip-rap rock in a 3'x 3' trench excavated down from the final floodplain surface elevation and extending south until the floodplain tied into the low terrace on the south bank. The proposed sill would be aligned

with the Duck Bridge abandoned rail grade. The sill is not intended to prevent an avulsion of the channel, but simply to limit floodplain scour, which over time could lead to an avulsion. Other options, such as combination log and rock sills, buried coir logs, brush windrows and other treatments will also be considered in the Phase 3 design. A practice that may be utilized throughout the restoration project area would be to locate similar sills wherever a grade control structure is located for a similar purpose (floodplain grade control until vegetation matures). These practices have been used successfully by the designers on a number of similar projects.

The DRP discusses the concept and criteria for slowly constricting the floodplain as the valley transitions from a laterally unconfined to a confined floodplain system from Reach CFR 3 downstream into Reach CFR 2. Leaving the Duck Bridge grade in place presents an abrupt and severe constriction of the floodplain, particularly after the Milltown Dam is removed. If left in place the Duck bridge grade is also inconsistent with the goal of restoring a channel and floodplain system consistent with the natural and historical condition. The backwater effect of the Duck Bridge grade during a large flood event would preclude leaving the fill in place as well as the negative aesthetic effects. The Peer Reviewers suggested a possible alternative of leaving the grade in place and phasing it out over time as floodplain vegetation matures. The costs and future disturbance of phasing out the grade may outweigh any potential benefits. This option will be considered in the Phase 3 design.

Comment 23. Grade Control Performance over a Range of Discharges. Page 8, paragraph 4: It is not clear that the proposed structures will meet the criterion to have no more than 0.5 to 1.0 foot drop at base flow conditions over the full range of flow conditions. Rating curves and profiles should be provided for any proposed grade control structure.

Response: The maximum drop in water surface over grade control structures will occur during base flow conditions. At greater discharges, the drop will become less or submerged. The designers have observed and monitored this process on similar projects with similar structures. Since considerable questions exist regarding the performance of grade control structures, Phase 3 will include a hydraulic analysis and safety evaluations of proposed grade control structures such as cross vanes and w-weirs.

Comment 24 and 39. Deer Creek Channel Stability and Fish Passage. Pg 8, paragraph 5, Pg 12, paragraph 5: The current plan proposes no structural control of the Deer Creek tributary, yet it appears that the bed at the confluence of Deer Creek and the CFR will be lowered about 7 to 8 feet.

Response: The proposed plan for reconstructing and connecting Deer Creek with the CFR is conceptual at this time. No hydrology or design elevations have been established because the issue of connecting Deer Creek with the CFR arose late in the Phase 2 process. The Deer Creek culvert and channel downstream from the culvert will be designed to provide fish passage from the Clark Fork River upstream to Deer Creek if deemed appropriate by MFWP. The pure strain westslope cutthroat trout population upstream of the culvert may be deemed critical and MFWP may select to maintain the genetic integrity of the population by limiting fish passage to the upper Deer Creek watershed.

Regardless of the decision on fish passage through the Deer Creek culvert, the concept is to construct a new channel that will be designed to converge with the CFR at an appropriate elevation and location. Grade control structures will be minimized. Based on the preliminary design and elevation information, the elevation of the bottom of the existing swale that currently carries Deer Creek water (also the proposed location for the new channel, Figure I-3, Appendix I) enters the CFR at approximately the correct floodplain elevation. The specific design for the Deer Creek culvert and channel will be addressed in Phase 3.

Comment 25: Additional Sediment Removal: Peer reviewers and the County recommended additional sediment removal, specifically the sediment to be left in SAAIII-b.

Response: The State has considered the removal of sediments that are to be left in place, specifically the sediments within the CFR channel just upstream of the dam. The ROD requires these sediments be protected from scour and be located out of the 100-year floodplain. Considering the requirement that these sediments will be protected from scouring by the remedial action and given the cost of removal of these sediments, estimated at $5 to 8 million dollars, this does not appear to be a cost effective alternative.

Comment 26. Construction Sequencing and Riparian Planting. Page 9, paragraph 2: The riparian restoration plan is thorough and appropriate. However, the proposed construction schedule would delay the planting of riparian vegetation until stage 3 (the third year). Because the project's ultimate performance presumably relies upon a healthy, mature and dynamic riparian system, areas largely unaffected by construction activities should be planted at the earliest opportunity to maximize root development and growth.

Response: The designers agree with the peer review recommendation to initiate revegetation in the areas that will not be otherwise disturbed at the earliest possible time. There is uncertainty at this time as to the exact remediation schedule and thus uncertainty concerning the restoration activities schedule. However, it is our goal to initiate any potential planting and weed control activities at the earliest possible time. The proposed construction sequencing will be edited to address this comment in the final restoration plan.

The following comments and responses are in relation to the DRP appendices. These comments are difficult to paraphrase, please refer to the page and paragraph shown for the exact comment.

Comment 27. Appendix A, Questions and Comments. Page 9, paragraph 3: There are numerous questions and comments concerning various topics. Please refer to referred location.

Response: Comments noted. However, addressing the comments will not change the results of the hydrology and flood series analysis. Therefore, no changes will be made to the DRP or carried over to Phase 3.

Comment 28. Appendix B, Reach Delineations. Page 10, paragraph 1: Peer Reviewers request that the reach delineations by shown in Appendix I using the stationing to define upstream/downstream boundaries.

Response: The designers agree that the reference reach delineations could be more clearly identified on a plan view sheet. Reference reaches will be delineated on Sheet I-7 to be submitted with the final restoration plan. Cross sections are identified by valley stationing. In addition, cross sections sheets K-7 through K-11 refer to the corresponding plan view sheet. Typical channel cross sections (sheets K-1 through K-6) do not correspond to a location, but rather a reach.

Comment 29. Appendix B, Typical Cross Sections. Page 10, paragraph 2: Peer reviewers asked that additional information be provided. Please see comment.

Response: The designers agree with this comment. Reference reaches cross sections and profiles will be delineated on a new sheet, Sheet I-7, to be submitted with the Final Restoration Plan.

Comment 30. Appendix B, Cross Sections and Water Surface Elevations. Page 10, paragraph 3: Peer reviewers asked for information concerning the water surface elevation and bankfull elevation as well as other questions. Please see comment.

Response The intent of the reference reach cross sections was to gain an understanding of bankfull characteristics. The water surface represented on the cross sections is the water level at the time of the survey. Additional analysis related to channel/floodplain interaction and inundation frequencies will be completed in Phase 3. Please refer to items 7, 8, 10 and 40 for additional discussion related to this topic.

Comment 31. Appendix B Bank Erodibility Hazard Index (BEHI) Applicability. Page 10, paragraph 4: Peer reviewers asked, what will the BEHI get us and how would a healthy stream compare? Also, they do not feel that the DRP provides a convincing argument that the braided reaches in CFR3 were similar to the reference reach in CFR3.

Response: The intent of Appendix B was to summarize and report existing conditions and reference reach data. The BEHI is a useful field method for evaluating relative bank stability. Although the evidence to support the historical condition of CFR3A may not be available, the designers support the conclusions presented in Appendix D, Geomorphic Assessment.

Comment 32. Appendix C, Definition of Stability. Page 10, paragraph 5: The Peer Reviewers ask for a definition of “channel stability.”

Response: As part of the effort to refine the project goals and objectives, a quantifiable measure of channel stability will be established. Most likely, it will be tied to natural stream erosion rates. An important part of the continued data collection and monitoring phases of this project

will be to develop baseline values for these parameters. This will be accomplished by measuring bank erosion and bed degradation using bank pins and scour chains. Therefore, it may not be possible to quantify baseline stream erosion or sediment transport volumes at this time.

The designers agree that channel stability and its role in this project should be clarified. In terms of the analyses in Appendix C, channel stability represents a condition where several hydraulic variables are balanced to achieve a state of dynamic equilibrium that approximates reference conditions, satisfies traditional hydraulic design principles and considers results from the best available regime equations. As described on page C-14, channel stability implies that although the channel pattern may change over time, the channels cross section area and slope remain consistent. Under stable conditions, rates of erosion and deposition are approximately balanced as the channel pattern changes.

In the absence of a standardized approach to stream channel design, the approach employed in the DRP, despite its apparent subjective nature, combines elements of several techniques that the designers feel represent the best available methods for assessing channel stability. As discussed in the first paragraph of Appendix C, interpreting results, measuring channel stability and establishing design thresholds must rely on the practitioner's experience and judgment rather than an accepted or standardized set of criteria.

Throughout Appendix C, conclusions are drawn from the analysis of each parameter. The conclusions compare the results of analog, empirical and analytical methods, with emphasis placed on results of analog methods (reference reaches). In the designers' experience, a range of +/-15% around a mean value for a specific parameter has been the guideline for the variation that a river reconstruction project can naturally accommodate before instability is triggered. Although a statistical analysis was not employed, this guideline, along with additional consideration of reference reach conditions, was employed as threshold design criteria for channel stability. It may be appropriate to apply this range using a sensitivity analysis in Phase 3.

Comment 33. Appendix C Sediment Continuity. Page 11, paragraph 1: Peer Reviewers ask several questions concerning Table C-7.

Response: Averages were calculated for a specified reach from results of the three methods for a specified discharge. Due to the volume of data produced in this analysis, the designers felt that this approach provided a concise summary of the results. However, Table C-7 could be presented in three tables that tabulate the results of each method.

Without baseline sediment data, it is difficult to ascertain which method generated the most reliable results. All three methods are suitable due to their applicability to gravel bed rivers.

The Monte-Carlo simulation described by Wilcock focuses on quantifying uncertainty in the determination of a critical discharge for the initiation of sediment transport. The designers recognize the importance of this exercise, but questions its applicability to estimate sediment transport rates, demonstrating sediment continuity and decreasing uncertainty of results that are

based on field data. It is recommended that further discussion occur between the designers and peer reviewers of whether this exercise should be included in the Phase 3 analysis. The uncertainty seems to lie in the different algorithms used in the formulae. Developing a range of uncertainty around results from one formula that are already orders of magnitude apart from others may not be helpful.

Comment 34. Appendix C, Painted Rocks Study. Page 11, paragraph 2: Peer reviewers recommend a painted rock study to analyzed the bedload movement in the project.

Response: The designers agree that a painted rocks study could provide useful insight to thresholds for incipient motion and critical particle size, however, there was not adequate time in Phase 2 to complete such a study. As discussed in response item 32, bank pins and scour chains have been installed and will be monitored throughout the project. It is believed that these exercises will produce a better understanding of sediment transport and scour in the project area. The designers maintain confidence in the accepted techniques and the quality of reference data to predict bed gradations for the proposed channels. A painted rocks study will be considered in Phase 3.

Comment 35. Appendix C, Table C-7, Sediment Transport Rates. Page 11, paragraph 3: Peer reviewers asked for clarification of Table C-7 and how some of the values were determined.

Response: Existing transport conditions in the lower end of CFR3/CFR2 are ignored since these reaches fall within Milltown Reservoir. The intent was to establish existing transport rates above and below the reservoir for comparison with design conditions. It is understood that existing transport continuity is disrupted by the reservoir.

The proposed CFR3/2 rate of 53,652 is an average value for the two reaches, taking into account the average floodplain width as the floodplain constricts through CFR2. The rates are presented in Figure C-3, but misleadingly labeled as CFR3. The designers agrees that it would be more appropriate to break this down into two rates to better demonstrate continuity through CFR2. The change will be incorporated into Phase 3 analyses.

Comment 36. Appendix C, Sediment Transport Rates through Project. Page 11, paragraph 4: Peer Reviewers comment that the sediment transport analyses does not provide a clear picture of the sediment continuity through the project.

Response: There appears to be confusion surrounding this topic because a map depicting the precise locations of the reference reaches is not explicitly presented in the plan. The best available illustration is presented in Figure C-9 on page C-20 in Appendix C. As shown in this figure, reference reaches are located upstream and downstream of the project area on the CFR and BFR. Therefore, sediment transport capacity through the reference reaches provides the required upstream and downstream values for the continuity analysis.

The designers agree that a profile of shear stress and stream power values through the project area at varying discharges would provide practical insight about sediment transport capacity. This effort will be undertaken in Phase 3.

<u>Comment 37. Appendix C, Sediment Continuity Analysis. Page 12, paragraph 2</u>: Peer Reviewers recommend calculating the sediment transport capacity for the entire range of flows and integrating this with the flow duration curve to estimate the potential for scour of deposition.

<u>Response</u>: The sediment continuity analysis was completed for a range discharges up to the 100-year discharge. However, only the bankfull results were displayed graphically. Results for other discharges are displayed in tabular format in Table C-7.

The designers agree that incorporating a flow duration curve in the analysis is appropriate in Phase 3. The designers also agree that breaking the project area into smaller reaches (more cross sections) is appropriate in Phase 3 when additional design detail is available.

<u>Comment 38. Appendix C Analysis Comments and Inconsistencies. Page 12, paragraph 3</u>: Several inconsistencies and errors were noted in the technical presentation. The peer reviewers noted that these inconsistencies and errors may not influence the final design, but should be addressed.

<u>Response</u>: The inconsistencies and errors noted are acknowledged, and they will be corrected. Correcting these errors does not significantly alter the results of the stability analysis or change the recommendations of the plan.

The designers disagree that the assessment of resistance coefficients is circular. Calculations and models were calibrated and based on field data. Velocity calculations were based on results of the roughness evaluation.

Comments 39 and 40 were addressed earlier in this document.

<u>Comment 41. Page G-8, paragraph 5</u>: The organic mulch may be a prospective source of non-native invasive plant seed depending on the source of this material, and should be investigated.

<u>Response</u>: All seed, organic material, and other material brought onto the site will need to meet State weed-free requirements. Risk of spreading weeds will be addressed in several ways: specifications will address specific materials like compost; all materials delivered to the site will be inspected for quality and to assess whether they meet specifications; and construction best management practices will provide guidelines for washing equipment to avoid transfer of undesirable seed to the project area. Terraseeding (blowing compost already pre-mixed with seed) may also be used in select areas. Terraseeding technology is weed free based on the cooking process used on the compost production. The final restoration plan will be edited to provide this additional detail.

Comment 42. Page G-9, Section G.4.2: Pruning the tops of salvaged trees to be equal to the root ball in size may improve transplanting survivability.

Response: This is our typical practice for salvage. This type of information, along with other information to increase success of salvage and transplant activities, will be included in the revegetation specifications that will be part of the final design.

Comment 43. Pages G- 9 and 10: Geomorphic features are classified as streambanks, floodplain, wetlands, and uplands. A greater diversity of geomorphic features could have been targeted for associating riparian species and community types, including emerging point bars, aggraded floodplains, aggraded oxbows, low terrace, and other terraces. The planting strategy (pp. 3-10 to 3-13) mentions micro-diversity of substrate patches, but should consider a macro-diversity related to these other geomorphic features.

Response: The four features (streambanks, floodplain, wetlands, and uplands) were used in the draft plan based on assumed hydrologic conditions post-construction and based on our observations during field visits. The designers believe the range of geomorphic classes used in the DRP was complex enough to capture major vegetation community type breaks, yet simple enough for a large scale planting plan to be implemented effectively. Diversity within each of the geomorphic features from a revegetation perspective was addressed to some extent within the text of the DRP and will be further described and illustrated in the final restoration plan. For example, seeding of created point bars with cottonwood and willow is included in the conceptual planting strategy for Streambanks and Floodplain areas. Upland features include terrace features and filled floodplain areas. Wetlands include filled oxbows. The designers believe the classes included in the DRP are based on proposed grading to capture the macro diversity (elevational and lateral ranges relevant to the new channel) of future riparian communities and species mixes prepare for the site. The final restoration plan may provide further detail on macro and micro diversity at the site if this detail is supported by final river and floodplain designs.

Comment 44. Appendix G: Water levels in the proposed wetland areas should be investigated prior to planting to ensure that these areas remain sufficiently wet for wetland vegetation. At this point, the future configuration of the water table with respect to the river is unknown, and while the plan assumes that the water table will be high enough to maintain wetlands, this isn't known with certainty.

Response: The designers recognize it is not possible to predict exact water levels that will result from the project at this time. It will be necessary to incorporate flexibility in the final design that will allow the plant material and seed mixes to be placed in appropriate locations that reflect the system's actual hydrologic response.

Comment 45. Appendix G: The plan should consider and predict likely changes in the riparian community if side-channels are isolated from mainstem flow and inundated only during occasional peak flows.

Response: The desired condition targets historical conditions, which was presumably a forested riparian community in an alluvial floodplain. Once the ponding effect from Milltown Dam is

removed, areas currently hydrologically modified by this effect may shift to a drier plant community. The plan addresses desired future conditions for the riparian plant communities post-construction. Rather than trying to predict changes in the plant community, it will be more important to monitor those changes. The final design will include strategies to ensure native plant species, rather than weeds, colonize these areas as the hydrology shifts. It is important to note that the overall restoration goal is aimed at restoring fluvial processes that result in a range of plant communities. The final restoration plan will add this more detailed description.

Comment 46. Page G-16, Section G.4.7: Red Osier Dogwood (*Cornus stolonifera*) and alder (*Alnus incana*) are also available on site and these plants will root adventitiously from cuttings by using the same methods as mentioned for the willow species.

Response: Locally, the designers have not had success establishing either of these species from cuttings in a field environment. Detailed specifications on harvesting and installing cuttings including appropriate species will be included in the final design.

Comment 47. Page G-21, Section G.4.9: There are 3 bioengineering techniques proposed but only two methods are described; need to add a description of pre-fabricated vegetated gabions.

Response: The description of pre-fabricated vegetated gabions will be included in the final restoration plan.

Comment 48. Page G-22, Section G.4.14: In areas with invasive plant growth you should consider herbicide spot treatments by trained personnel rather than “starting over,” which could quickly become an expensive proposition.

Response: A more detailed plan for weed management pre, during and post construction will be included in the final design. This plan will specify areas where spot treatment using herbicide will be effective and areas where more intensive weed treatments are needed to allow native plant communities to establish. “Starting over” may include grading where grading needs to occur anyway, or soil amendments to create conditions more favorable to native species and less favorable to weeds.

Comment 49. Appendix G: An aggressive plan for combating weed invasion, though somewhat vague at this point (it consists mostly of listing options) is important. How well have these listed strategies worked locally?

Response: Each of the listed strategies is conceptual, and based on strategies that have been implemented locally. Weed control is one of the more challenging aspects of native plant community restoration; therefore, in the conceptual plan, the designers emphasized the need for weed management to be considered during the entire revegetation process. The final design will include more specific weed management strategies and these strategies will be presented in the context of construction phasing and maintenance after construction has been completed. As part of the final design, the designers will emphasize aspects of other revegetation activities, for example, use of mulch and compost, that have proven to effectively pre-empt weed infestations.

Also, because weeds will be part of continued maintenance on the site, the designers will include specific weed control strategies, including herbicides.

Comment 50. Page G-25 and G-27, Tables G11 and G-12: Could consider live staking as another bioengineering method using on-site vegetation, particularly in the floodplain where there are no bioengineering treatments being proposed.

Response: Willow cuttings are included under Planting Strategies and Techniques and will be used in streambank areas, either as a stand-alone treatment or incorporated into soil lifts. Willow cuttings could also be included under bioengineering treatments, but the designers typically define bioengineering as techniques that integrate living plant material with an erosion-resistant material that provides soil stability in areas where soil by itself is not stable enough to support plant establishment.

ATTACHMENT: REVISED GOALS AND OBJECTIVES

Draft Restoration Plan September 2005

Goals and Objectives[1]

The Trustees revised the goals and objectives presented in the Draft Conceptual Restoration Plan (DCRP) for the DRP per the peer reviewers recommendations. The review panel agreed wit the conceptual goals and objectives but suggested more explicit wording that corresponded with our more detailed data and understanding of the site.

<u>Overall Project Goal</u>: Restore the confluence of the Blackfoot and Clark Fork Rivers to a naturally functioning, stable system. This goal can be achieved with the understanding that:

- Infrastructure, contaminated sediment repositories, private land and the geomorphic setting must be maintained;
- Erosion and migration of the river channels is part of a naturally functioning and stable river system. In the long-term, vegetation such as cottonwoods and willows is integral this restoration;
- For the short-term (15-25 years) after reconstruction, structures will be relied upon to provide stability until the vegetation is mature. To the extent possible, structures will be similar to those naturally occurring in less altered sections of the rivers.

<u>1. Goal</u>: Improve water quality by reducing the erosion of contaminated sediments.

- Rock, wood, and vegetation will be used to construct instream, streambank, and floodplain structures mimicking natural structures found in other, similar Montana rivers; non-native biodegradable material may be used. (Measurement[2]: Material used is native or it is not, structure consistent with setting);
- Bank and in-stream structures installed to maintain channel and floodplain stability until vegetation has matured on the floodplain and streambank;
    - After the streambank and floodplain vegetation has matured (15 to 25 years) the channel and bank structures will have degraded allowing the river to migrate and develop channel(s) naturally across the floodplain (Measurement: Channel migration starts after vegetation has met ROD requirements and is structurally effective, monitor erosion rates, bed stability (aggradations/degradation) compared to reference reaches).

<u>2. Goal</u>: Provide channel and floodplains that will accommodate sediment transport and channel dynamics appropriate for the geomorphic setting.

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[1] These goals and objectives were defined for the Draft Restoration Plan, April 2005. These goals and objectives will need to be refined further during the Final Design to reflect the monitoring that will be identified to measure the success of this project.

[2] Measurements are listed as potential guidelines for which goals and objectives will be measured. Examples of indices are listed as indices that could be used. Further refinement in the restoration planning and development of the monitoring and maintenance plan will discuss the indices that will be used.

- Design parameters for the channel to allow the 1.5 to 2.0 year flood frequency to access the floodplain. Design of the floodplain, terrace, and wetland features will accommodate all levels of flooding consistent with setting. Channel and meander geometry will remain consistent over time. (Measurement: sediment is transported through restored reaches without excess aggradations or scour, channel hydraulic geometry remains within design criteria. Bank pins, cross-sections, and profiles will be monitored);
- Revegetation of the streambank and floodplain using a diverse community structure will be an integral part of the floodplain design (Measurement: ROD requirements met or exceeded)

3. Goal: Provide high quality habitat for all native fishes and other trouts, including continuous upstream and downstream migration while minimizing habitats that will promote undesirable fish species.

- Channel design will provide habitat features similar to reference conditions and consistent with stream type or geomorphic setting. Instream and bank structures will maintain habitat features until bank and floodplain vegetation matures allowing the geomorphic forces to create this habitat naturally. (Measurement: Goal 3 met thru achievement of Goals 1 and 2);
- To the extent practicable while restoring these large river systems, habitats favorable to northern pike or other potential undesirable species, e.g., shallow, slow, and warm water will be eliminated. (Measurement: northern pike spawning areas eliminated and not created)

4. Goal: Provide functional wetlands and riparian communities, where feasible. These communities will also provide improved riparian and wildlife habitat within the restored area.

- Wetland design will reference upstream and downstream wetland areas (Measurement: created wetlands with equal or higher ranking than exists in upstream or downstream wetland areas);
- Use of a diverse vegetation plan will improve wetland quality (Measurement: created wetlands with equal or higher ranking than exists in upstream or downstream wetland areas);
- A majority of the floodplain should develop into wetlands, but is dependent on groundwater elevations after dam removal. (Measurement: measure wetland areas).
- Revegetation activities proposed increase floodplain vegetation diversity and provide for long-term floodplain and channel stability. (Measurement: ROD, Appendix G)

5. Goal: Improve visual and aesthetic values through natural channel design, revegetation and the use of native plants and materials.

- The design will create a riparian zone that has a diverse vegetative cover (Measurement: vegetation ROD requirements met);
- The river channel design will function similar to reference sections (Measurement: channel maintains designed stream type and dimensions, see goal #1);
- Revegetation, floodplain, and channel design will consider other proposed land uses (Measurement: integration of other restoration projects considered to the extent practicable without compromising these Goals and Objectives).

6. Goal: Provide safe recreational opportunities compatible with other restoration goals, such as channel and floodplain stability, sediment transport, and fish habitat.

- Establishing a naturally functioning system within the boundaries and limits present at the site are a priority; however, safety considerations will be evaluated with every aspect of the project. A totally safe river system cannot be built, rivers are inherently dangerous, and a system that is similar to other rivers in similar environments within Montana will be used to guide decision makers. (Measurement: Met goals 1 thru 5.)